FINAL SUBMITTAL

# ENERGY SURVEYS OF
# ARMY INDUSTRIAL FACILITIES
# ENERGY ENGINEERING ANALYSIS PROGRAM
# LETTERKENNY ARMY DEPOT
# CHAMBERSBURG, PENNSYLVANIA

## VOLUME IV

## PROGRAMMING DOCUMENTS

CONTRACT NO. DACA65-91-C-0071

PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS
NORFOLK, VIRGINIA



PREPARED BY:

ENERGY AND ENVIRONMENTAL SERVICES DEPARTMENT
REYNOLDS, SMITH AND HILLS, INC.
P.O. BOX 4850
JACKSONVILLE, FLORIDA 32201
904/279-2277

RS&H PROJECT NO. 2900379001

JANUARY 1992

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# QRIP

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC QRIP

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE: Compressed Air Shut-Off Valves

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 8,108 (Project Cost) ÷ 4,004 (Average Annual Savings) X 12 (No. Mos) = 2.0 (years) or _____ (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE:

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S):
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION:
Replace existing compressed gate-type shut-off valves with ball valve type.

18. DETAILED JUSTIFICATION:
Unlike gate valves, ball valves shut off quickly with a single motion through a $90^{0}$ angle. It requires little access, on-off position is easily identified and is less susceptible to leaking.

19. SAVINGS DISPOSITION:
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* Electricity | $4,004 | $0 | $0 | $0 | $0 | $4,004 | $4,004 | $4,004 | $4,004 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* | | | | | | | | | |
| TOTALS | $4,004 | $0 | $0 | $0 | $0 | $4,004 | $4,004 | $4,004 | $4,004 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 8,108 by average annual savings 4,004 = 2.0 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = .66 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 4,004 X discount factor 9.524 = 38,134 and divide by present value of investment *(undiscounted)* 8,108 = 4.70 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*

*Page 2 of DA Form 5108-R*

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE a | PROPOSED SOURCE OF PROCUREMENT b | UNIT PRICE c | QUANTITY d | TOTAL COST e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f | FY FUNDS REQUIRED g |
|---|---|---|---|---|---|---|
| (1) Compressed air ball valves | | $35.56 | 228 | $8,108 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION (Equipment delivery) | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER (Specify): | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $8,108 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $8,108 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | | | |
| (16) TOTAL (Sum of (14) + (15) above) | | | | $8,108 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

*Page 3 of DA Form 5108-R*

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) Electricity | | | $4,004 | | | | | | |
| (9) | | | | | | | | | |
| (10) | | | | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $4,004 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

*Page 4 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

*(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)*

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

| | | |
|---|---|---|
| 25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY *(MACOM/Agency)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| *FOR USE BY HQDA ON OSD PIF PROJECTS ONLY* | | |
| 27. APPROVED BY | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

28. OTHER REMARKS *(Cont'd)*

*Page 5 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 1

COMPRESSED AIR VALVE REPLACEMENT IN BUILDING 350

Discussion

Building 350 is constructed with a one-inch diameter compressed air supply on each of the 228 columns. Typically, these air stations are arranged with a shut-off gate valve followed by one or more quick disconnect compressed air hose fittings. The problem is that many of the air stations are leaking compressed air continuously.

All the leaks are in valve stem packings or hose connections downstream of the manual, gate-type, shut-off valve located on the column. Typically, these valves are left open all the time, allowing the compressed air to leak out. The background noise is too high to hear the leaks, and the workmen often wear gloves so they cannot feel them either. It is cumbersome to shut off a gate valve which requires multiple turns, particularly if access to it is blocked by surrounding equipment. A ball valve shuts off quickly (requiring on a single motion through 90° angle), requires little excess, and is less susceptible to leaking.

Based on the results of a leak survey (see Appendix B), it is estimated that about half of the 228 columns in Building 350, have a detectable leak. These leaks total 85 cfm and cost approximately $4,000 annually.

Recommendations

It is recommended that the compressed air shut-off valve on each column in Building 350 be changed from the existing gate valve to a ball valve; and that this new valve be closed at all times when compressed air is not in use. Typically, this would be at the end of a workman's shift.

| | |
|---|---|
| Construction Cost | $7,271 |
| Annual Energy Savings (MBtu/yr) | |
| Electricity | 366 |
| Annual Energy Cost Savings ($/yr) | $4,004 |
| SIR | 7.5 |
| Simple Payback (years) | 2.0 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO1
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #1 COMPRESSED AIR VALVE REPLACEMENT
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

| | | |
|---|---|---|
| A. CONSTRUCTION COST | $ | 7271. |
| B. SIOH | $ | 400. |
| C. DESIGN COST | $ | 437. |
| D. SALVAGE VALUE COST | -$ | 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ | 8108. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 366. | $ 4004. | 15.11 | 60501. |
| B. DIST | $ 7.43 | 0. | $ 0. | 21.31 | 0. |
| C. RESID | $ 6.61 | 0. | $ 0. | 25.22 | 0. |
| D. NAT G | $ .00 | 0. | $ 0. | 20.70 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 15.93 | 0. |
| F. TOTAL | | 366. | $ 4004. | | $ 60501. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 14.53 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 19965.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 4004.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 60501.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 7.46
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 2.02

RS&H

SUBJECT LETTERKENNY A.D. ECO #1
AEP NO 290-0379-001
SHEET 1 OF
DESIGNER G. FALLON
DATE
CHECKER P. Hutchins
DATE

# ECO #1 Compressed Air Valve Replacement in Bldg 350

EACH COLUMN CONTAINS AT LEAST ONE COMPRESSED AIR ROOT VALVE. DRAWINGS SHOW 4 ROWS OF 57 COLUMNS EACH, TOTAL 228 COLUMNS => 228 ± AIR STATIONS. 40 COL'S HAD LEAKS.

COLUMNS SURVEYED

B19 THRU B57 AND C11 THRU C57 => 84 COL'S

PERCENT W/LEAKS

$$\frac{40}{84} \times 100 = 47.62\%$$

ESTIMATED COL'S W/LEAKS

228 COL'S × .4762 = 109 COL'S.

TOTAL ESTIMATED LEAKAGE

Σ LEAKS = 31 CFM

$$\frac{31 \text{ CFM}}{40 \text{ COL'S}} \times 109 \text{ COL'S} = 84.5 \text{ CFM.}$$

TOTAL VALUE OF LEAKS

$$84.5 \text{ CFM} \times \frac{60 \text{ m}}{\text{H}} \times \frac{8760 \text{ H}}{\text{YR.}} \times \frac{0.009 \text{ MBTU}}{1000 \text{ cf}} \times \frac{\$10.94}{\text{MBTU}} \approx \$4000/\text{YR}$$

TOTAL ENERGY SAVED

$$\frac{\$4000}{\text{YR}} \times \frac{\text{MBTU}}{\$10.94} = 366 \text{ MBTU/YR.}$$

RS·H

# Telephone Call Confirmation

(704) 529-2104

Project No. 290-0379-001

Local ____ L.D. ✓ Placed ✓ Rec'd. ____ Date ____

G. Fallon Conversed With Tom Knowland

Of Ingersol-Rand Regarding Compressor Energy Use

TK gave the following energy use values:

| CFM | Bhp | PSIG | Btuh/CFM | kwh/kcf | MBTU/kcf |
|---|---|---|---|---|---|
| 1595 | 319 | 110 | 509 | 2.70 | 0.0092 |
| 1560 | 330 | 125 | 538 | 2.86 | 0.0098 |
| 1603 | 306 | 100 | 485 | 2.57 | 0.0088 |

CALC ENERGY USE PER [redacted] CFM OF AIR

MOTOR EFF = 0.92

Distribution:

RS&H®

SUBJECT LEAD ECO #1 AEP NO

SHEET 2 OF

DESIGNER G. Fallon DATE

CHECKER P. Hotchkiss DATE

COST of BALL VALVE

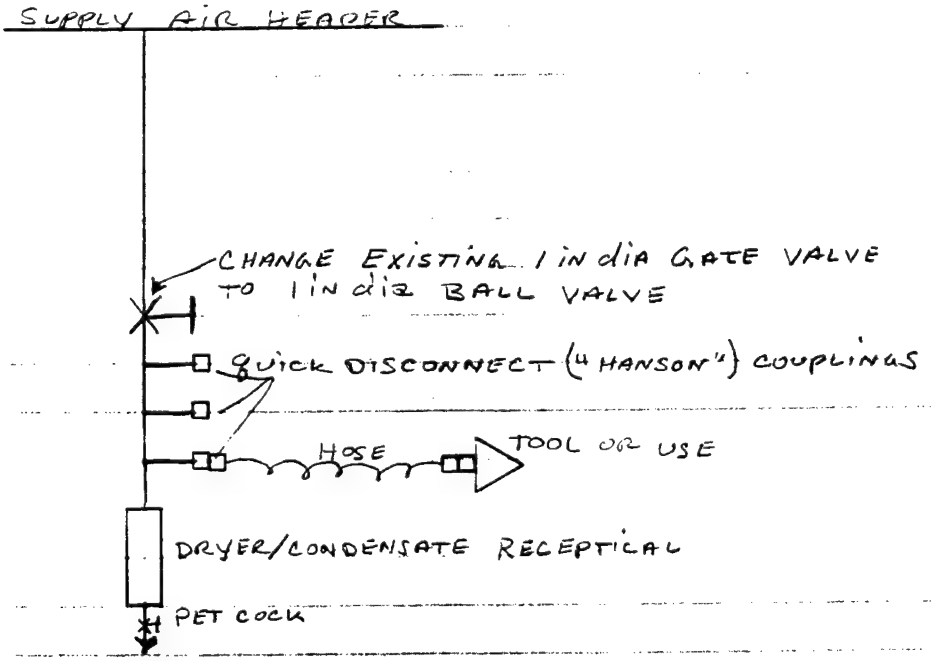
FROM MEANS, ITEM 151-955-1470
AND FROM CONSTRUCTION COST CALCULATION (ATTACHED)

228 VALVES = #8131

PAYBACK

$\frac{\#8131}{\#4000/yr} = 2.0$ years

SKETCH




NOTE: EXISTING GATE VALVE OFTEN HAS LEAKY VALVE STEM AND ARE RARELY CLOSED. THIS ALLOWS DOWNSTREAM LEAKS TO CONTINUE. VALVE IS "DIFFICULT" TO SHUT OFF. BALL VALVE IS QUICK SHUT OFF TYPE. THEREFOR MORE LIKELY TO BE SHUT OFF BY WORKERS WHEN ASKED TO DO SO.

05/09/91

ECO Construction Cost Estimate
Calculations

ECO Name: Air Valves Replacement in Building 350

ECO #: 1

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $2,109 |
| Labor | $2,440 |
| Subtotal bare costs | $4,549 |
| FICA Insurance (20% of Labor) | $488 |
| Sales Tax (6.5% of Material) | $137 |
| Subtotal | $5,174 |
| Overhead (15%) | $776 |
| Subtotal | $5,950 |
| Profit (10%) | $595 |
| Subtotal | $6,545 |
| Bond (1%) | $65 |
| Subtotal | $6,610 |
| Contingency (10%) | $661 |
| Subtotal (Construction Cost Input For LCCID *) | $7,271 |
| SIOH (5.5% of Construction Cost) | $400 |
| Subtotal | $7,671 |
| Design (6% of Construction Cost) | $436 |
| Total Project Cost | $8,107 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: Letterkenny Army Depot

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR: G. Fallon

CHECKED BY

ECO #1 SUMMARY

| | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|---|---|---|---|---|---|---|---|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| 1 IN Ø BALL VALVE | 228 | EA | 10.70 | 2440 | 9.25 | 2109 | 4549 |

ECO #1

LETTERKENNY ARMY DEPOT
COMPRESSED AIR SURVEY
BUILDING 350

| COLUMN/ LOCATION ID | LEAK* DETECTION TECHNIQUE | FLOW** (CFM) | COMMENT |
|---|---|---|---|
| B26 | A | 0.659 | VALVE PACKING (MEASURED) |
| B54 | A | 1 | VALVE PACKING |
| C24 | A | 1.5 | 1 HOSE COUPLING |
| C28 | A | 1.5 | DRYER DRAIN |
| C32 | A | 1.5 | VALVE PACKING |
| C47 | A | 1 | VALVE PACKING |
| PB60 | A | 4.1 | DRYER DRAIN PAINT BOOTH 60 (MEASURED |
| B19 | D | <0.5 | VALVE PACKING (MEASURED) |
| B23 | D | <0.5 | VALVE PACKING |
| B27 | D | <0.5 | HOSE COUPLING |
| B30 | D | <0.5 | HOSE COUPLING |
| B31 | D | <0.5 | HOSE COUPLING |
| B35 | D | <1.5 | 3 HOSE COUPLING |
| B36 | D | <0.5 | 1 HOSE COUPLING |
| B37 | D | <0.5 | 1 HOSE COUPLING (BREATHABLE AIR) |
| B38 | D | >0.5 | 1 HOSE COUPLING |
| B50 | D | <0.5 | VALVE PACKING |
| C21 | D | <0.5 | 1 HOSE COUPLING |
| C36 | D | <0.5 | 1 HOSE COUPLING |
| C38 | D | <0.5 | VALVE PACKING (BREATHABLE AIR) |
| C39 | D | <0.5 | VALVE PACKING (BREATHABLE AIR) |
| C42 | D | <0.5 | VALVE PACKING |
| C46 | D | <0.5 | 1 HOSE COUPLING |
| C51 | D | <0.5 | 1 HOSE COUPLING |
| C52 | D | <0.5 | 1 HOSE COUPLING |
| C54 | D | <0.5 | 1 HOSE COUPLING |
| C55 | D | <0.5 | DRAIN COCK |
| B39 | F | 1 | 1 HOSE COUPLING |
| B46 | F | 1 | VALVE PACKING (MEASURED) |
| B48 | F | 1 | VALVE PACKING |
| B51 | F | 1 | VALVE PACKING |
| B55 | F | 1 | DRAIN COCK |
| C11 | F | <1 | 1 HOSE COUPLING |
| C13 | F | <1 | 1 HOSE COUPLING |
| C14 | F | 1 | DRYER DRAIN |
| C17 | F | <1 | 1 HOSE COUPLING |
| C18 | F | <1 | 1 HOSE COUPLING |
| C23 | F | 1 | 1 HOSE COUPLING |
| C25 | F | 1 | 1 HOSE COUPLING |
| C31 | F | 1 | 1 HOSE COUPLING |
| C45 | F | 1 | VALVE PACKING |

31

* A = AUDIBLE TO HUMAN EAR WITH "AT WORK" BACKGROUND NOISE
D = DETECTOR ONLY. LEAK COULD NOT BE HEARD OR FELT
F = CAN BE FELT WITH HAND

** FLOW WAS MEASURED IN EACH OF THE MAJOR CATAGORIES (A,D,F).
FLOW WAS ESTIMATED BASED ON CATAGORY OF DETECTION SENSITIVITY

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC QRIP

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE: Condensate Heat Recovery

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 2,703 (Project Cost) ÷ 4,100 (Average Annual Savings) X 12 (No. Mos) = 0.7 (years) or _____ (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 25

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S):
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION:
Recover heat from dip tanks condensate which is otherwise disposed as industrial waste water.

18. DETAILED JUSTIFICATION:
Because dip tanks contain chemicals that are harmful to boiler water, condensate is not returned. This project recovers the heat from the waste condensate to be used to heat the building interior.

19. SAVINGS DISPOSITION:
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* #6 Fuel Oil | 33,800 | 29,700 | 29,700 | 29,700 | 29,700 | 4,100 | 4,100 | 4,100 | 4,100 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* _____ | | | | | | | | | |
| TOTALS | 33,800 | 29,700 | 29,700 | 29,700 | 29,700 | 4,100 | 4,100 | 4,100 | 4,100 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 2,703 by average annual savings 4,100 = 0.66 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 300 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 4,100 X discount factor 9,524 = 39,000 and divide by present value of investment *(undiscounted)* 2,703 = 14.4 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requirements cannot be used in this computation.)*



*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE a | PROPOSED SOURCE OF PROCUREMENT b | UNIT PRICE c | QUANTITY d | TOTAL COST e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f | FY FUNDS REQUIRED g |
|---|---|---|---|---|---|---|
| (1) Hydronic heaters | - | $901 | 3 | $2,703 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION (Equipment delivery) | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER (Specify): | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $2,703 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $2,703 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL (Sum of (14) + (15) above) | | | | $2,703 | | |

[1] Not to exceed 10% of equipment cost for QRIP projects.

[2] Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.

[3] Normally not OPA funded.

[4] Used to compute amortization in Item 11.

[5] Specify source to include certification that funds are available, if financed from the regular budget:

Page 3 of DA Form 5108-R

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.*

| 22. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)* | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | | |
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) #6 Fuel Oil | | | $4,100 | | | | | | |
| (9) | | | | | | | | | |
| (10) | | | | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $4,100 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

*Page 4 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

_____

*(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)*

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

_____

_____

| | | |
|---|---|---|
| 25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY *(MACOM/Agency)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

*FOR USE BY HQDA ON OSD PIF PROJECTS ONLY*

| | | |
|---|---|---|
| 27. APPROVED BY | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

28. OTHER REMARKS *(Cont'd)*

*Page 5 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 6

CONDENSATE HEAT RECOVERY FOR BOILERS IN BUILDING 349

## Discussion

This ECO identifies known steam and condensate losses, assesses their recoverability and evaluates their economic impact.

Steam losses for deaerator heating, atomizing steam, soot blowing and steam cleaning are all vented directly or indirectly to the atmosphere. Condensate losses from dip tank heating may be contaminated by chemicals used in various processes and water losses from boiler blowdown are "dirty" and unsuitable for return. One energy savings option is to recover the heat from the various streams.

The heat in the boiler blowdown can be recovered for boiler makeup. The heat in the dip tank condensate can be used to heat building air during the heating season. Both of these options are evaluated in this ECO.

## Recommendations

Based on the Life Cycle Cost Analysis, heat recovery from the boiler blowdown is not recommended. However, heat recovery from dip tank condensate in Buildings 350N, 350S and 370 are recommended.

| | |
|---|---|
| Construction Cost | $2,423 |
| Annual Energy Savings (MBtu/yr) | |
| No. 6 Fuel Oil | 938 |
| Annual Energy Cost Savings ($/yr) | $4,100 |
| SIR | 38.6 |
| Simple Payback (years) | 0.7 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO6
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #6 HEAT RECOVERY FROM CONDENSATE
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

| | | |
|---|---|---|
| A. CONSTRUCTION COST | $ | 2423. |
| B. SIOH | $ | 134. |
| C. DESIGN COST | $ | 146. |
| D. SALVAGE VALUE COST | -$ | 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ | 2703. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 0. | $ 0. | 15.11 | 0. |
| B. DIST | $ 4.98 | 0. | $ 0. | 21.31 | 0. |
| C. RESID | $ 4.41 | 938. | $ 4137. | 25.22 | 104325. |
| D. NAT G | $ .00 | 0. | $ 0. | 20.70 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 15.93 | 0. |
| F. TOTAL | | 938. | $ 4137. | | $ 104325. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 14.53 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 34427.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 4137.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 104325.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 38.60
(IF < 1 PROJECT DOES NOT QUALIFY)

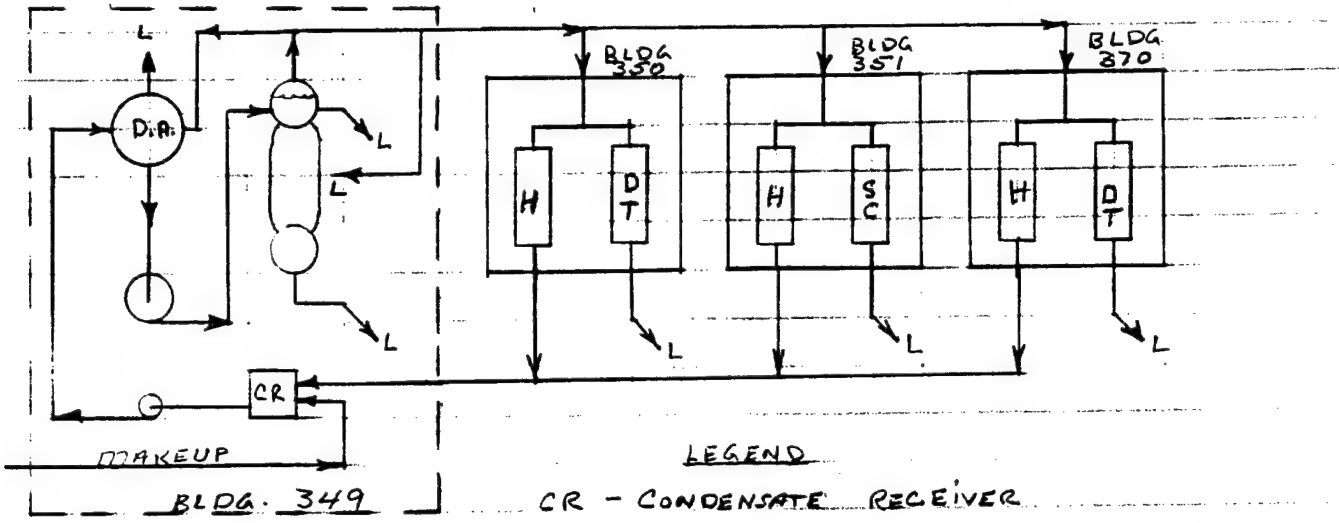
7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .65

RS&H

SUBJECT LETTERKENNY A.D. ECO #6 — AEP NO 290-0379-001
SHEET ____ OF ____
DESIGNER G.F. — DATE ____
CHECKER ____ — DATE ____

# ECO#6 – REDUCE MAKEUP WATER REQUIREMENTS AT BLDG. 349

## PROCESS FLOW DIAGRAM - MAIN BOILER (#349)




LEGEND

CR - CONDENSATE RECEIVER
DA - DEAERATING FEEDWATER HEATER
DT - DIP TANK HEATING
H - COMFORT HEATING
L - LOSS
SC - STEAM CLEANING.

| | STEAM LOSSES | HEAT RECOVERABLE | CONDENSATE RECOVERABLE |
|---|---|---|---|
| 1. | D. A. VENT | NO | NO |
| 2. | CONTINUOUS BLOWDOWN | YES | NO |
| 3. | BOTTOM BLOWDOWN | YES | NO |
| 4. | SOOT BLOWER | NO | NO |
| 5. | ATOM. STEAM | NO | NO |
| 6. | BLDG 350 DIPTANKS | YES | NO |
| 7. | BLDG 351 STEAM CLEAN | NO | NO |
| 8. | BLDG 370 DIP TANKS | YES | NO |

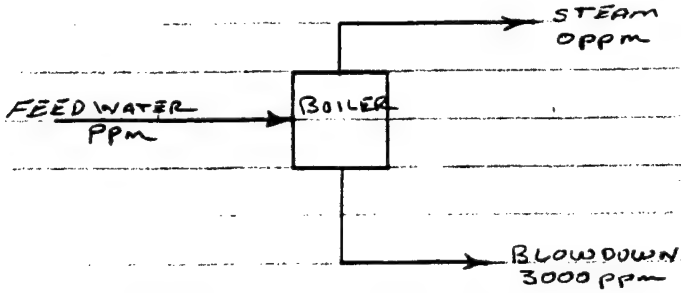
RS&H

SUBJECT LETTER KENNY A.D. ECO #6 | AEP NO | SHEET 2 OF | DESIGNER | DATE | CHECKER | DATE

HEAT RECOVERY FROM BOILER BLOWDOWN (Items 2 & 3)

DETERMINE BLOWDOWN FLOW

ASSUME: 3000 ppm TDS BOILER WATER (ABMA STD)
: 30 ppm IN FEEDWATER




$\Sigma$ water = 0 = FEEDWATER − STEAM FLOW − BLOW DOWN = $m_f - m_s - m_B$

$\Sigma$ SOLIDS = 0 = FEEDWATER X CONC. − STEAM FLOW X CONC. − BLOWDOWN X CONC

$0 = m_f \times C_f - m_s C_s - m_B C_B$

$0 = m_f C_f - (m_f - m_B) C_s - m_B C_B$ (0)

$0 = m_f C_f - m_B C_B$

$m_B = m_f \frac{C_f}{C_B} = m_f \frac{30}{3000} = .001\, m_f$

SO BLOWDOWN ≈ .1% of STEAM FLOW

TOTAL STEAM PRODUCTION

$$\text{TOTAL STEAM PRODUCTION} = \frac{\text{TOTAL FUEL CONSUMPTION}}{\text{BOILER EFF} \times \Delta H}$$

$$= \frac{188\,598 \text{ MBTU/yr}}{.8 \times (1188.1 - (.8 \times 148 + .2 \times 28))}$$

= 221.5 MILLION LBS STEAM/yr.

TOTAL BLOW DOWN

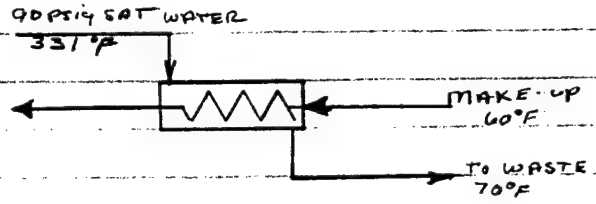
$221.5 \times 10^6 \times .001 = 221.5 \times 10^3$ LBS/yR.

RS&H®

SUBJECT LEAD ECO #6 | AEP NO
SHEET OF
DESIGNER | DATE
CHECKER | DATE

## RECOVERABLE ENERGY IN BLOW DOWN

ASSUME: 10° ΔT COLD END APPROACH
90 psig BOILER PRESSURE
MAKE-UP WATER TEMP = 60°F




$$\dot{Q} = \dot{w} c_p \Delta T = \frac{221.5 \times 10^3 \text{ LBS/yr} \times (331 - 70)}{0.8 \times 10^6} = 72.3 \text{ MBTU/yr}$$

#601C

## VALUE OF RECOVERED ENERGY

72.3 MBTU/yr × $6.61/MBTU = $478./yr.

CONSTRUCTION COST = $9297

PAYBACK = $\frac{\$9297}{\$478/yr}$ = 19.4 YEARS ⇒ NOT RECOMMENDED

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SUBJECT LEAD
ECO #6
DESIGNER
CHECKER

AEP NO
SHEET OF
DATE
DATE

## HEAT RECOVERY FROM DIP TANK CONDENSATE.

### DIP TANK STEAM CONSUMPTION

DURING NON-WORK SUMMERTIME WEEKENDS THE ONLY STEAM CONSUMERS ARE THE DIP TANKS IN BUILDINGS 350 & 370. SINCE THESE ARE THE ONLY CONSUMERS AND THE CONDENSATE IS DUMPED, THE MAKEUP FLOW IS EQUAL TO THE STEAM FLOW AND THE CONDENSATE FLOW.

### 1990 AUGUST WEEKEND MAKEUP FLOW DATA

| DATE | MAK-UP FLOW (GPD) |
|---|---|
| 4 | 2891 |
| 5 | 2800 |
| 11 | 2800 |
| 12 | 2800 |
| 18 | 3200 |
| 19 | 3300 |
| 25 | 4000 |
| 26 | 3300 |
| TOTAL | 25100 |
| AVERAGE (GPD) | 3140 |
| AVERAGE (#/HR) | 1090 |

THERE ARE 11 HEATED TANKS TOTALING 19,200 GAL. THE TANKS OPERATE AT APPROXIMATELY THE SAME TEMPERATURE. THE STEAM CAN BE ASSUMED TO BE CONSUMMED AS A FUNCTION OF TANK CAPACITY. THE CONDENSATE TEMPERATURE IS EQUAL TO THE TANK TEMPERATURE

$$\frac{1090\ \#/HR}{19200\ gal} = 0.0568\ \#\ STEAM/HR/gal$$

RS&H

SUBJECT LEAD ECO #6 | AEP NO
SHEET OF
DESIGNER | DATE
CHECKER | DATE

350 N

4 TANKS @ 3000 gal ea = 12,000 gal
2 TANKS @ 500 gal ea = 1000 gal
13,000 gal

TOTAL STEAM CONSUMPTION

13,000 gal X 0.0568 # STEAM/HR/gal = 738 LBS STM/HR.

RECOVERABLE ENERGY IN CONDENSATE

ASSUME: 68°F INDOOR TEMP., 10° H/X APPROACH.
738 LBS. STM/HR X (180 − 78) = 75,300 BTU/HR

ANNUAL HEAT RECOVERY

$\frac{75300 \text{ BTU/HR}}{10^6 \text{ BTU/MBTU} \times 0.8} \times 6687 \text{ HR/YR} = 629 \text{ MBTU/YR}$ #6 OIL

RS&H

SUBJECT LEAD ECO #6 | AEP NO | SHEET | OF | DESIGNER | DATE | CHECKER | DATE

350 S

2 TANKS @ 1600 gal ea = 3200 gal

TOTAL STEAM CONSUMPTION

3200 gal × 0.0568 #STM/HR/gal = 182 LBS STM/HR

RECOVERABLE ENERGY IN CONDENSATE

182 LBS STM/HR × (180 − 78) = 18500 BTU/HR

ANNUAL HEAT SAVED

$$\frac{18500 \text{ BTU/HR}}{10^6 \text{ BTU/MBTU} \times 0.8} \times 6687 \text{ HRS/YR} = 155 \text{ MBTU/YR } \#6 \text{ OIL}$$

RS&H

SUBJECT LEAD
ECO #6

AEP NO

SHEET OF

DESIGNER

DATE

CHECKER

DATE

370

3 TANKS @ 1000 gal @ = 3000 gal

TOTAL STEAM CONSUMPTION

3000 gal x 0.0568 #S/HR·gal = 170 LBS STM/HR

RECOVERABLE ENERGY IN CONDENSATE

170 LBS STM/HR x (180 - 72) = 18400 BTU/HR

ANNUAL ENERGY RECOVERY

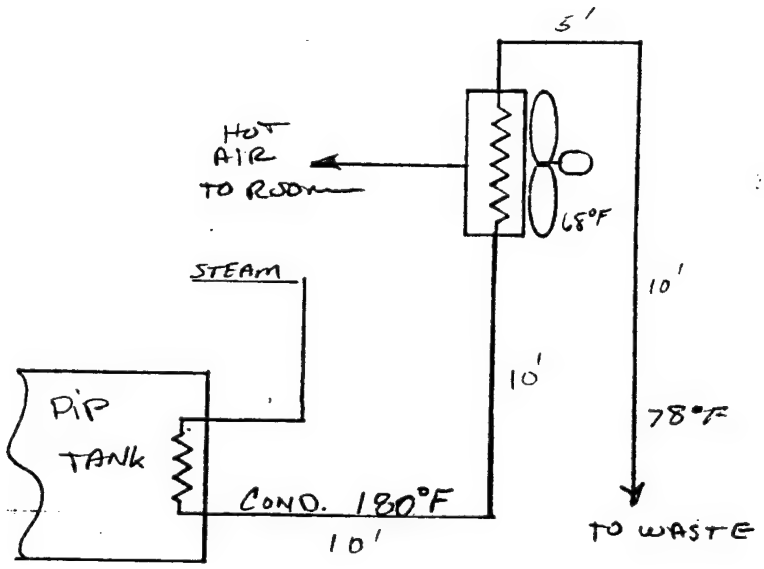
$$\frac{18400\ \text{Btu/HR}}{10^6\ \text{Btu/mole} \times 0.8} \times 6687\ \text{HRS/YR} = 154\ \frac{\text{MBTU}}{\text{YR}}\ \#601$$

RS•H®

SUBJECT LEAD
ECO #6
DESIGNER
CHECKER

AEP NO
SHEET OF
DATE
DATE

# DIP TANK CONDENSATE HEAT RECOVERY




1 HYDRONIC HEATER
35 ft-1" ø SCH 40 PIPE.
3 1" ø " " ELS.
NO INSULATION!

ONE UNIT REQUIRED @ EACH GROUP of DIP TANKS, 3 TOTAL.

TOTAL ENERGY SAVED = 129 + 155 + 154 = 938 MBTU/yr

TOTAL CONSTRUCTION COST $2701

## QRIP Calculations

Present energy use = {(738 + 182 + 170) #/hr} * 6687 hr/yr * 1050 Btu/lb

= 7653 MBtu/yr * 4.41 #/MBtu = #33,800/yr

LETTERKENNY ARMY DEPOT ENERGY AUDIT OF INDUSTRIAL FACILITIES

Operation Hrs/Day = 24

| | | |
|---|---|---|
| Room or Supply Air Conditions - Winter | | 68 |
| Air Quantity (cfm) | | 1 |
| Hour Fractions | 1 AM - 9 AM | 1 |
| | 9 AM - 5 PM | 1 |
| | 5 PM - 1 AM | 1 |
| Operation Days Per Week | | 5 |

| Temp. Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Total Hours | Delta H or T | Const. | CFM | BTU/HR | Total BTU |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 785 | -4 | 1.08 | 1 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 791 | 1 | 1.08 | 1 | 1 | 854 |
| 60 | 64 | 269 | 196 | 236 | 701 | 6 | 1.08 | 1 | 6 | 4,542 |
| 55 | 59 | 249 | 191 | 209 | 649 | 11 | 1.08 | 1 | 12 | 7,710 |
| 50 | 54 | 221 | 193 | 202 | 616 | 16 | 1.08 | 1 | 17 | 10,644 |
| 45 | 49 | 218 | 193 | 206 | 617 | 21 | 1.08 | 1 | 23 | 13,994 |
| 40 | 44 | 237 | 236 | 239 | 712 | 26 | 1.08 | 1 | 28 | 19,993 |
| 35 | 39 | 289 | 246 | 286 | 821 | 31 | 1.08 | 1 | 33 | 27,487 |
| 30 | 34 | 304 | 194 | 258 | 756 | 36 | 1.08 | 1 | 39 | 29,393 |
| 25 | 29 | 184 | 106 | 152 | 442 | 41 | 1.08 | 1 | 44 | 19,572 |
| 20 | 24 | 124 | 65 | 90 | 279 | 46 | 1.08 | 1 | 50 | 13,861 |
| 15 | 19 | 75 | 32 | 57 | 164 | 51 | 1.08 | 1 | 55 | 9,033 |
| 10 | 14 | 54 | 13 | 26 | 93 | 56 | 1.08 | 1 | 60 | 5,625 |
| 5 | 9 | 18 | 3 | 9 | 30 | 61 | 1.08 | 1 | 66 | 1,976 |
| 0 | 4 | 9 | 0 | 2 | 11 | 66 | 1.08 | 1 | 71 | 784 |
| -5 | -1 | 3 | 0 | 1 | 4 | 71 | 1.08 | 1 | 77 | 307 |
| -10 | -6 | 1 | 0 | 0 | 1 | 76 | 1.08 | 1 | 82 | 82 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 1.08 | 1 | 87 | 0 |
| Totals | | 2798 | 2122 | 2552 | 7472 | | | | | 165,858 |

| | | |
|---|---|---|
| Total Operation Hours While Heating (and corrected for working days/week) | 4776 | 118,470 |
| Avg outdoor temp while heating (F) | 45.0 | |

7472
- 785
6687 HRS of HEATING

05/16/91

ECO Construction Cost Estimate
Calculations

ECO Name: Condensate heat recovery - dip tank heat exchanger

ECO #: 6

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $1,310 |
| Labor | $274 |
| Subtotal bare costs | $1,584 |
| FICA Insurance (20% of Labor) | $55 |
| Sales Tax (6.5% of Material) | $85 |
| Subtotal | $1,724 |
| Overhead (15%) | $259 |
| Subtotal | $1,983 |
| Profit (10%) | $198 |
| Subtotal | $2,181 |
| Bond (1%) | $22 |
| Subtotal | $2,203 |
| Contingency (10%) | $220 |
| Subtotal (Construction Cost Input For LCCID *) | $2,423 |
| SIOH (5.5% of Construction Cost) | $133 |
| Subtotal | $2,556 |
| Design (6% of Construction Cost) | $145 |
| Total Project Cost | $2,701 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION:

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: G. Fallon

CHECKED BY: P. Hutchins

DIP TANK COND
HEAT RECOV. ECO #6 — SUMMARY

| | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|---|---|---|---|---|---|---|---|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| 1 HYDRONIC HEATER | | | | | | | |
| MEANS NO. 155630 4000 | 3 | EA | 31 | 93 | 415 | 1250 | 1340 |
| 1" SCH 40 PIPE | 35 | LF | 3.84 | 134 | 1.49 | 52 | 186 |
| 1" " " ELS | 3 | EA | 15.65 | 47 | 1.30 | 4 | 51 |
| | | | | 274 | | 1310 | 1580 |

ENG FORM 1 AUG 59 150 (ER 1110-345-730) PREVIOUS EDITION MAY BE USED. * U.S. GOVERNMENT PRINTING OFFICE : 1980 O—000000 (TRANSLUCENT)

05/16/91

ECO Construction Cost Estimate
Calculations

ECO Name: Condensate heat recovery - blow down heat exchanger

ECO #: 6

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $3,340 |
| Labor | $1,980 |
| Subtotal bare costs | $5,320 |
| FICA Insurance (20% of Labor) | $396 |
| Sales Tax (6.5% of Material) | $217 |
| Subtotal | $5,933 |
| Overhead (15%) | $890 |
| Subtotal | $6,823 |
| Profit (10%) | $682 |
| Subtotal | $7,505 |
| Bond (1%) | $75 |
| Subtotal | $7,580 |
| Contingency (10%) | $758 |
| Subtotal (Construction Cost Input For LCCID *) | $8,338 |
| SIOH (5.5% of Construction Cost) | $459 |
| Subtotal | $8,797 |
| Design (6% of Construction Cost) | $500 |
| Total Project Cost | $9,297 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION:

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.:

ESTIMATOR: G. Fallon

CHECKED BY: P. Hutchins

BLOWDOWN HEAT RECOVERY - ECO 6 SUMMARY

| | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|---|---|---|---|---|---|---|---|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| BLOW DOWN HEAT H/X | | | | | | | |
| MEANS ITEM NO | | | | | | | |
| 155601180 | 1 | ea | 185 | 185 | 2160 | 2160 | 2350 |
| 2" ø SCH 40 PIPE | 200 | LF | 5.75 | 1150 | 2.91 | 582 | 1730 |
| 2" ø CAL. SIL INSULATION | 200 | LF | 2.22 | 444 | 2.22 | 444 | 890 |
| 2" ø STEEL ELS. | 10 | EA | 20 | 200 | 15.7 | 157 | 360 |
| | | | | 1980 | | 3340 | 5330 |

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC QRIP

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE: Paint Booth Exhaust Fan Controls

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 5,135 (Project Cost) ÷ $23,000 (Average Annual Savings) X 12 (No. Mos) = 0.2 (years) or – (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 15

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S):
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION:
This project provides controls for nine paint booths that will allow exhaust air use only when occupied.

18. DETAILED JUSTIFICATION:
For convenience, paint booth exhaust fans are left on continuously during work shifts. This project shuts off the exhaust fan when unoccupied and saves energy.

19. SAVINGS DISPOSITION:
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* Elec. & #6 Fuel Oil | 45,800 | 24,200 | 24,200 | 24,200 | 24,200 | 21,600 | 21,600 | 21,600 | 21,600 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* _____ | | | | | | | | | |
| TOTALS | 45,800 | 24,200 | 24,200 | 24,200 | 24,200 | 21,600 | 21,600 | 21,600 | 21,600 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 5,135 by average annual savings 23,000 = 0.2 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 300+ % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 23,000 X discount factor 7.98 = $183,500 and divide by present value of investment *(undiscounted)* 5,135 = 33.6 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*



*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)—Continued.*

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE a | PROPOSED SOURCE OF PROCUREMENT b | UNIT PRICE c | QUANTITY d | TOTAL COST e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f | FY FUNDS REQUIRED g |
|---|---|---|---|---|---|---|
| (1) Occupancy Sensor | | $571 | 9 | $5,135 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION *(Equipment delivery)* | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER *(Specify):* | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $5,135 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $5,135 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL *(Sum of (14) + (15) above)* | | | | $5,135 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

*Page 3 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

22. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) Electricity | | | $1,400 | | | | | | |
| (9) #6 Fuel Oil | | | $21,600 | | | | | | |
| (10) | | | | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $23,000 | | | | | | |

6 *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*



*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

| 24. REGULATORY APPROVAL/COORDINATION | | |
|---|---|---|
| a. INVESTMENT STATEMENT<br>This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.<br>(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.) | | |
| b. OTHER COORDINATION (Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.) | | |
| 25. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator) | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY (MACOM/Agency) | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| FOR USE BY HQDA ON OSD PIF PROJECTS ONLY | | |
| 27. APPROVED BY | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| 28. OTHER REMARKS (Cont'd) | | |

Page 5 of DA Form 5108-R

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO9
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #9 PAINT BOOTH FAN CONTROLS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

| | |
|---|---|
| A. CONSTRUCTION COST | $ 4604. |
| B. SIOH | $ 254. |
| C. DESIGN COST | $ 277. |
| D. SALVAGE VALUE COST | -$ 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ 5135. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 124. | $ 1357. | 10.75 | 14583. |
| B. DIST | $ 4.98 | 0. | $ 0. | 14.08 | 0. |
| C. RESID | $ 4.41 | 4895. | $ 21587. | 16.21 | 349924. |
| D. NAT G | $ .00 | 0. | $ 0. | 13.25 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 11.13 | 0. |
| F. TOTAL | | 5019. | $ 22944. | | $ 364507. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 10.59 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 120287.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 22944.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 364507.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 70.98
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .22

ECO Number: 9

PAINT BOOTH FAN CONTROL

Discussion

Paint booth exhaust fans operate continuously during the shift when painting is to be done. However, the fan is required to operate only when paint is being applied.

This ECO provides controls for nine paint booths that will turn the fan off if no one has been in the paint booth for three minutes, and will turn it on whenever any one enters the booth.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

| | |
|---|---|
| Construction Cost | $4,604 |
| Annual Energy Savings (MBtu/yr) | |
| No. 6 Oil | 4,895 |
| Electricity | 124 |
| Annual Energy Cost Savings ($/yr) | $22,900 |
| SIR | 71.0 |
| Simple Payback (years) | 0.2 |

RS&H

SUBJECT LETTERKENNY A.D. AEP NO 290-0379-001
ECO 9 SHEET 1 OF
DESIGNER G. F. DATE
CHECKER DATE

ECO # 9 Paint Booth Fan Control : Bldg 350, Booth #61

CURRENT ENERGY COSTS

NO. 6 OIL

ASSUME: 68°F EXHAUST AIR, 2 SHIFT OPERATION
74,233 BTU/CFM/YR.
12141 CFM EXHAUST FLOW
BOILER EFFICIENCY = 0.8

HEAT LOSS F491 Fuel prices except for Q

$$HL = \frac{74{,}233\ B/CFM/yR \times 12141\ CFM}{0.8 \times 10^6} = 1127\ MBTU/yR$$

HEAT LOSS COST

1130 MBTU/YR x $4.41/MBTU = $4983/YR

ELECTRICITY

ASSUME: 2 HP MOTOR (BKA, INC. REPORT)

ENERGY CONSUMED

2 HP x .746 KW/HP x 16H/d x 5 d/w x 52 w/yR = 6210 KWH
= 21. MBTU/YR

COST

6210 KWH x $0.0373/KWH = $230/YR

TOTAL COST

$4983/YR + $230/YR = $5213/YR

SAVINGS

ASSUME: FAN IS OFF FOR 1/2 TIME

RS&H

SUBJECT LEAD ECO #9 AEP NO

SHEET 2 OF

DESIGNER DATE

CHECKER DATE

SAVINGS CONT.

No. 6 OIL

ENERGY

$\frac{1127 \text{ MBTU/YR}}{2} = 564 \text{ MBTU/YR}$

COST

$564 \text{ MBTU/YR} \times \$4.41/\text{MBtu} = \$2487/\text{YR}$

ELECTRICITY

ENERGY

$\frac{6210 \text{ kWh/yr}}{2} = 3110 \text{ kWh/yr} = 11 \text{ MBTU/yr}$

COST

$3110 \text{ kWh/yr} \times \$0.0373/\text{kWh} = \$120/\text{yr}.$

TOTAL SAVINGS

COST SAVINGS = OIL SAVINGS + ELEC. SAVINGS

$= \$2487/\text{yr} + \$120/\text{yr}$

$= \$2607/\text{yr}$

ENERGY SAVINGS $= 564 \frac{\text{MBtu}}{\text{yr}} + 11 \frac{\text{MBtu}}{\text{yr}}$

$= 575 \text{ MBtu/yr}$

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 350 |
| Paint Booth No.: | 2527 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 5 HP |
| Exhaust Air Flow: | 25,959 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 74,233 Btu/cfm-Yr |
| Operating Shifts: | 2 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 2409 MBtu/Yr |
| Heating Energy Cost = | $10,624 /Yr |
| Current Electric Use = | 53 MBtu/Yr |
| Electricity Cost = | $580 /Yr |
| Current Energy Use = | 2462 MBtu/Yr |
| Current Energy Cost = | $11,204 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 1205 MBtu/Yr |
| Heating Cost Savings = | $5,314 /Yr |
| Electric Energy Savings = | 27 MBtu/Yr |
| Electric Cost Savings = | $295 /Yr |
| Total Energy Savings = | 1232 MBtu/Yr |
| Total Energy Cost Savings = | $5,609 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 37 |
| Paint Booth No.: | 280 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 3 HP |
| Exhaust Air Flow: | 18,318 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 74,233 Btu/cfm-Yr |
| Operating Shifts: | 2 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 1700 MBtu/Yr |
| Heating Energy Cost = | $7,497 /Yr |
| Current Electric Use = | 32 MBtu/Yr |
| Electricity Cost = | $350 /Yr |
| Current Energy Use = | 1732 MBtu/Yr |
| Current Energy Cost = | $7,847 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 850 MBtu/Yr |
| Heating Cost Savings = | $3,749 /Yr |
| Electric Energy Savings = | 16 MBtu/Yr |
| Electric Cost Savings = | $175 /Yr |
| Total Energy Savings = | 866 MBtu/Yr |
| Total Energy Cost Savings = | $3,924 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 37 |
| Paint Booth No.: | 468 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 2 HP |
| Exhaust Air Flow: | 11,152 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 74,233 Btu/cfm-Yr |
| Operating Shifts: | 2 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 1035 MBtu/Yr |
| Heating Energy Cost = | $4,564 /Yr |
| Current Electric Use = | 21 MBtu/Yr |
| Electricity Cost = | $230 /Yr |
| Current Energy Use = | 1056 MBtu/Yr |
| Current Energy Cost = | $4,794 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 518 MBtu/Yr |
| Heating Cost Savings = | $2,284 /Yr |
| Electric Energy Savings = | 11 MBtu/Yr |
| Electric Cost Savings = | $120 /Yr |
| Total Energy Savings = | 529 MBtu/Yr |
| Total Energy Cost Savings = | $2,404 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 37 |
| Paint Booth No.: | 470 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 3 HP |
| Exhaust Air Flow: | 12,069 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 74,233 Btu/cfm-Yr |
| Operating Shifts: | 2 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 1120 MBtu/Yr |
| Heating Energy Cost = | $4,939 /Yr |
| Current Electric Use = | 32 MBtu/Yr |
| Electricity Cost = | $350 /Yr |
| Current Energy Use = | 1152 MBtu/Yr |
| Current Energy Cost = | $5,289 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 560 MBtu/Yr |
| Heating Cost Savings = | $2,470 /Yr |
| Electric Energy Savings = | 16 MBtu/Yr |
| Electric Cost Savings = | $175 /Yr |
| Total Energy Savings = | 576 MBtu/Yr |
| Total Energy Cost Savings = | $2,645 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 370 |
| Paint Booth No.: | 200 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 5 HP |
| Exhaust Air Flow: | 17,100 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 35,618 Btu/cfm-Yr |
| Operating Shifts: | 1 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 761 MBtu/Yr |
| Heating Energy Cost = | $3,356 /Yr |
| Current Electric Use = | 26 MBtu/Yr |
| Electricity Cost = | $284 /Yr |
| Current Energy Use = | 787 MBtu/Yr |
| Current Energy Cost = | $3,640 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 381 MBtu/Yr |
| Heating Cost Savings = | $1,680 /Yr |
| Electric Energy Savings = | 13 MBtu/Yr |
| Electric Cost Savings = | $142 /Yr |
| Total Energy Savings = | 394 MBtu/Yr |
| Total Energy Cost Savings = | $1,822 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 370 |
| Paint Booth No.: | 412 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 1.5 HP |
| Exhaust Air Flow: | 6,147 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 35,618 Btu/cfm-Yr |
| Operating Shifts: | 1 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 274 MBtu/Yr |
| Heating Energy Cost = | $1,208 /Yr |
| Current Electric Use = | 8 MBtu/Yr |
| Electricity Cost = | $88 /Yr |
| Current Energy Use = | 282 MBtu/Yr |
| Current Energy Cost = | $1,296 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 137 MBtu/Yr |
| Heating Cost Savings = | $604 /Yr |
| Electric Energy Savings = | 4 MBtu/Yr |
| Electric Cost Savings = | $44 /Yr |
| Total Energy Savings = | 141 MBtu/Yr |
| Total Energy Cost Savings = | $648 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 370 |
| Paint Booth No.: | 3877 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 2 HP |
| Exhaust Air Flow: | 11,956 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 35,618 Btu/cfm-Yr |
| Operating Shifts: | 1 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 532 MBtu/Yr |
| Heating Energy Cost = | $2,346 /Yr |
| Current Electric Use = | 11 MBtu/Yr |
| Electricity Cost = | $120 /Yr |
| Current Energy Use = | 543 MBtu/Yr |
| Current Energy Cost = | $2,466 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 266 MBtu/Yr |
| Heating Cost Savings = | $1,173 /Yr |
| Electric Energy Savings = | 6 MBtu/Yr |
| Electric Cost Savings = | $66 /Yr |
| Total Energy Savings = | 272 MBtu/Yr |
| Total Energy Cost Savings = | $1,239 /Yr |

ECO #9
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/14/91

| | |
|---|---|
| Building Number: | 370 |
| Paint Booth No.: | 4298 |
| Heating Fuel Type: | #6 Fuel Oil |
| Heating Fuel Cost: | $4.41 /MBtu |
| Boiler Efficiency: | 80% |
| Electricity Cost: | $10.94 /MBtu |
| Exhaust Fan Motor: | 7.5 HP |
| Exhaust Air Flow: | 18,592 CFM |
| Makeup Percentage: | 100% |
| Exhaust Air Temp.: | 68 °F |
| O A Heating Load: | 35,618 Btu/cfm-Yr |
| Operating Shifts: | 1 /Day |
| Operating Days: | 5 /Week |

Current Energy Use:

| | |
|---|---|
| Current Heating Energy = | 828 MBtu/Yr |
| Heating Energy Cost = | $3,651 /Yr |
| Current Electric Use = | 40 MBtu/Yr |
| Electricity Cost = | $438 /Yr |
| Current Energy Use = | 868 MBtu/Yr |
| Current Energy Cost = | $4,089 /Yr |

Savings if fan is turned off 50% of the time:

| | |
|---|---|
| Heating Energy Savings = | 414 MBtu/Yr |
| Heating Cost Savings = | $1,826 /Yr |
| Electric Energy Savings = | 20 MBtu/Yr |
| Electric Cost Savings = | $219 /Yr |
| Total Energy Savings = | 434 MBtu/Yr |
| Total Energy Cost Savings = | $2,045 /Yr |

ECO #9 Project Summary
Fan Controls For Open Paint Booths
Letterkenny Army Depot
10/21/91

4.41 4.41 10.94

| Building Number | Booth Number | Energy Savings (MBtu/Yr) #5 Oil | #6 Oil | Elect | Total | Energy Cost Savings ($/Yr) #5 Oil | #6 Oil | Elect | Total | CURRENT COSTS FUEL OIL | ELEC. | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 350 | 61 | | 564 | 11 | 575 | $0 | $2,487 | $120 | $2,608 | $4,983 | $230 | $5,213 |
| 350 | 2527 | | 1205 | 27 | 1232 | $0 | $5,314 | $295 | $5,609 | $10,624 | $580 | $11,204 |
| 37 | 280 | 850 | | 16 | 866 | $3,749 | $0 | $175 | $3,924 | $7,497 | $350 | $7,847 |
| 37 | 468 | 518 | | 11 | 529 | $2,284 | $0 | $120 | $2,405 | $4,564 | $230 | $4,794 |
| 37 | 470 | 560 | | 16 | 576 | $2,470 | $0 | $175 | $2,645 | $4,939 | $350 | $5,289 |
| 370 | 200 | | 381 | 13 | 394 | $0 | $1,680 | $142 | $1,822 | $3,356 | $284 | $3,640 |
| 370 | 412 | | 137 | 4 | 141 | $0 | $604 | $44 | $648 | $1,208 | $88 | $1,296 |
| 370 | 3877 | | 266 | 6 | 272 | $0 | $1,173 | $66 | $1,239 | $2,346 | $120 | $2,466 |
| 370 | 4298 | | 414 | 20 | 434 | $0 | $1,826 | $219 | $2,045 | $3,651 | $438 | $4,089 |
| Total Project | | 1928 | 2967 | 124 | 5019 | $8,502 | $13,084 | $1,357 | $22,944 | $43,168 | $2,670 | $45,838 |

# 21,600

ECO 9

LETTERKENNY ARMY DEPOT ENERGY AUDIT OF INDUSTRIAL FACILITIES

Operation Hrs/Day = 8

| | | |
|---|---|---|
| Room or Supply Air Conditions - Winter | | 68 |
| Air Quantity (cfm) | | 1 |
| Hour Fractions | 1 AM - 9 AM | 0.25 |
| | 9 AM - 5 PM | 0.75 |
| | 5 PM - 1 AM | 0 |
| Operation Days Per Week | | 5 |

| Temp. Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Total Hours | Delta H or T | Const. | CFM | BTU/HR | Total BTU |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 240 | -4 | 1.08 | 1 | 0 | 0 |
| 65 | 69 | 236 | 217 | 278 | 237 | 1 | 1.08 | 1 | 1 | 256 |
| 60 | 64 | 269 | 196 | 236 | 214 | 6 | 1.08 | 1 | 6 | 1,388 |
| 55 | 59 | 249 | 191 | 209 | 206 | 11 | 1.08 | 1 | 12 | 2,441 |
| 50 | 54 | 221 | 193 | 202 | 200 | 16 | 1.08 | 1 | 17 | 3,456 |
| 45 | 49 | 218 | 193 | 206 | 199 | 21 | 1.08 | 1 | 23 | 4,519 |
| 40 | 44 | 237 | 236 | 239 | 236 | 26 | 1.08 | 1 | 28 | 6,634 |
| 35 | 39 | 289 | 246 | 286 | 257 | 31 | 1.08 | 1 | 33 | 8,596 |
| 30 | 34 | 304 | 194 | 258 | 222 | 36 | 1.08 | 1 | 39 | 8,612 |
| 25 | 29 | 184 | 106 | 152 | 126 | 41 | 1.08 | 1 | 44 | 5,557 |
| 20 | 24 | 124 | 65 | 90 | 80 | 46 | 1.08 | 1 | 50 | 3,962 |
| 15 | 19 | 75 | 32 | 57 | 43 | 51 | 1.08 | 1 | 55 | 2,355 |
| 10 | 14 | 54 | 13 | 26 | 23 | 56 | 1.08 | 1 | 60 | 1,406 |
| 5 | 9 | 18 | 3 | 9 | 7 | 61 | 1.08 | 1 | 66 | 445 |
| 0 | 4 | 9 | 0 | 2 | 2 | 66 | 1.08 | 1 | 71 | 160 |
| -5 | -1 | 3 | 0 | 1 | 1 | 71 | 1.08 | 1 | 77 | 58 |
| -10 | -6 | 1 | 0 | 0 | 0 | 76 | 1.08 | 1 | 82 | 21 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 1.08 | 1 | 87 | 0 |
| Totals | | 2798 | 2122 | 2552 | 2291 | | | | | 49,865 |

| | | |
|---|---|---|
| Total Operation Hours While Heating (and corrected for working days/week) | 1465 | 35,618 |
| Avg outdoor temp while heating (F) | 45.0 | |

ECO 9

LETTERKENNY ARMY DEPOT ENERGY AUDIT OF INDUSTRIAL FACILITIES

Operation Hrs/Day = 16

| | | |
|---|---|---|
| Room or Supply Air Conditions - Winter | | 68 |
| Air Quantity (cfm) | | 1 |
| Hour Fractions | 1 AM - 9 AM | 0.375 |
| | 9 AM - 5 PM | 1 |
| | 5 PM - 1 AM | 0.625 |
| Operation Days Per Week | | 5 |

| Temp. Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Total Hours | Delta H or T | Const. | CFM | BTU/HR | Total BTU |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 518 | -4 | 1.08 | 1 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 502 | 1 | 1.08 | 1 | 1 | 542 |
| 60 | 64 | 269 | 196 | 236 | 444 | 6 | 1.08 | 1 | 6 | 2,880 |
| 55 | 59 | 249 | 191 | 209 | 415 | 11 | 1.08 | 1 | 12 | 4,930 |
| 50 | 54 | 221 | 193 | 202 | 402 | 16 | 1.08 | 1 | 17 | 6,949 |
| 45 | 49 | 218 | 193 | 206 | 404 | 21 | 1.08 | 1 | 23 | 9,151 |
| 40 | 44 | 237 | 236 | 239 | 474 | 26 | 1.08 | 1 | 28 | 13,317 |
| 35 | 39 | 289 | 246 | 286 | 533 | 31 | 1.08 | 1 | 33 | 17,849 |
| 30 | 34 | 304 | 194 | 258 | 469 | 36 | 1.08 | 1 | 39 | 18,244 |
| 25 | 29 | 184 | 106 | 152 | 270 | 41 | 1.08 | 1 | 44 | 11,956 |
| 20 | 24 | 124 | 65 | 90 | 168 | 46 | 1.08 | 1 | 50 | 8,334 |
| 15 | 19 | 75 | 32 | 57 | 96 | 51 | 1.08 | 1 | 55 | 5,274 |
| 10 | 14 | 54 | 13 | 26 | 50 | 56 | 1.08 | 1 | 60 | 2,994 |
| 5 | 9 | 18 | 3 | 9 | 15 | 61 | 1.08 | 1 | 66 | 1,013 |
| 0 | 4 | 9 | 0 | 2 | 5 | 66 | 1.08 | 1 | 71 | 330 |
| -5 | -1 | 3 | 0 | 1 | 2 | 71 | 1.08 | 1 | 77 | 134 |
| -10 | -6 | 1 | 0 | 0 | 0 | 76 | 1.08 | 1 | 82 | 31 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 1.08 | 1 | 87 | 0 |
| Totals | | 2798 | 2122 | 2552 | 4766 | | | | | 103,927 |

| | | |
|---|---|---|
| Total Operation Hours While Heating (and corrected for working days/week) | 3035 | 74,233 |
| Avg outdoor temp while heating (F) | 45.0 | |

09/25/91

ECO Construction Cost Estimate
Calculations

ECO Name: Walk-in Spray Booth Fan Control

ECO #: 9

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $1,179 |
| Labor | $1,683 |
| Subtotal bare costs | $2,862 |
| FICA Insurance (20% of Labor) | $337 |
| Sales Tax (6.5% of Material) | $77 |
| Subtotal | $3,276 |
| Overhead (15%) | $491 |
| Subtotal | $3,767 |
| Profit (10%) | $377 |
| Subtotal | $4,144 |
| Bond (1%) | $41 |
| Subtotal | $4,185 |
| Contingency (10%) | $419 |
| Subtotal (Construction Cost Input For LCCID *) | $4,604 |
| SIOH (5.5% of Construction Cost) | $253 |
| Subtotal | $4,857 |
| Design (6% of Construction Cost) | $276 |
| Total Project Cost | $5,133 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: Letterkenny Army Depot

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE:
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.:

ESTIMATOR: G.F.

CHECKED BY: P. Hutchins

WALK-IN SPRAY BOOTH FAN CONTROL SUMMARY

| | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|---|---|---|---|---|---|---|---|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| OCCUPANCY SENSOR | 1 | EA | 25 | 25 | 80 | 80 | 105 |
| CONDUIT ½" Ø | 50 | LF | 2.97 | 149 | .96 | 48 | 197 |
| WIRE 2-14 | 0.5 | KLF | 26.78 | 13 | 6.22 | 3 | 16 |
| | | | | | | | |
| Subtotal For 1 Booth | | | | 187 | | 131 | 318 |
| x No. of Booths | | | | x 9 | | x 9 | |
| | | | | | | | |
| Total Bare Costs | | | | $1,683 | | $1,179 | $2862 |

ENG FORM 1 AUG 59 150 (ER 1110-345-730) PREVIOUS EDITION MAY BE USED * U.S. GOVERNMENT PRINTING OFFICE : 1980 O—616140 (TRANSLUCENT)

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC QRIP

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE: Blast Booth Exhaust Fan Controls

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: $ 7,280 (Project Cost) ÷ 17,613 (Average Annual Savings) X 12 (No. Mos) = 0.4 (years) or - (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 15

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S):
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION:
Limit switches are used to allow blast booth exhaust fans to operate only when doors are closed.

18. DETAILED JUSTIFICATION:
Currently, blast booth exhaust fans remain on continuously throughout the work shifts. This project will save energy by shutting down exhaust fans when booths are not in use.

19. SAVINGS DISPOSITION:
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* Electricity | $37,919 | $20,306 | $20,306 | $20,306 | $20,306 | $17,613 | $17,613 | $17,613 | $17,613 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* _____ | | | | | | | | | |
| TOTALS | $37,919 | $20,306 | $20,306 | $20,306 | $20,306 | $17,613 | $17,613 | $17,613 | $17,613 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 7,280 by average annual savings 17,613 = 0.4 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 300+ % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 17,613 X discount factor 7.98 = 140,552 and divide by present value of investment *(undiscounted)* 7,280 = 19.3 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*



*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE a | PROPOSED SOURCE OF PROCUREMENT b | UNIT PRICE c | QUANTITY d | TOTAL COST e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f | FY FUNDS REQUIRED g |
|---|---|---|---|---|---|---|
| (1) Limit Switches | - | $1,820 | 4 | $7,280 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION (Equipment delivery) | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER (Specify): | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $7,280 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $7,280 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL (Sum of (14) + (15) above) | | | | $7,280 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

*Page 3 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) Electricity | | | $17,613 | | | | | | |
| (9) | | | | | | | | | |
| (10) | | | | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $17,613 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

*Page 4 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

| 24. REGULATORY APPROVAL/COORDINATION | | |
|---|---|---|
| a. INVESTMENT STATEMENT<br>This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.<br>_____<br>*(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)* | | |
| b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*<br>_____<br>_____ | | |
| 25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY *(MACOM/Agency)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| *FOR USE BY HQDA ON OSD PIF PROJECTS ONLY* | | |
| 27. APPROVED BY | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 28. OTHER REMARKS *(Cont'd)* | | |

*Page 5 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 11

BLAST BOOT FAN SHUT-OFF (BUILDINGS 350 AND 37)

Discussion

The blast booth exhaust fan draws air from the building interior, circulates it through the booth and a bag house, and discharges it back into the building. This fan must be operated whenever blasting is under way. However, there is no reason for the fan to operate when the blast booth is not being utilized and the doors are open.

This ECO provides electrical equipment that will automatically stop the exhaust fan when the large booth doors are not fully closed. One limit switch mounted on each pair of doors will indicate the doors are closed and the fan may be started. The fan will operate until one of the large doors opens, or until the stop button is depressed.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

| | |
|---|---|
| Construction Cost | $6,529 |
| Annual Energy Savings (MBtu/yr) | |
| Electricity | 1,610 |
| Annual Energy Cost Savings ($/yr) | $17,613 |
| SIR | 26.0 |
| Simple Payback (years) | 0.4 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO11
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ARREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #11 BLAST BOOTH FAN CONTROL (B350)
FISCAL YEAR 1991 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 09-11-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

| | | |
|---|---|---|
| A. CONSTRUCTION COST | $ | 6529. |
| B. SIOH | $ | 359. |
| C. DESIGN COST | $ | 392. |
| D. SALVAGE VALUE COST | -$ | 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ | 7280. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 1610. | $ 17613. | 10.75 | 189344. |
| B. DIST | $ 7.43 | 0. | $ 0. | 14.08 | 0. |
| C. RESID | $ 6.61 | 0. | $ 0. | 16.21 | 0. |
| D. NAT G | $ .00 | 0. | $ 0. | 13.25 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 11.13 | 0. |
| F. TOTAL | | 1610. | $ 17613. | | $ 189344. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 10.59 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 62484.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 17613.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 189344.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 26.01
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 .41

RS&H®

SUBJECT LETTER KENNY A D. ECO #11 | AEP NO 290-0379-001
SHEET 1 OF 5
DESIGNER G.E. | DATE
CHECKER P. Hutchins | DATE

ECO #11

BLAST BOOTH FAN SHUT-OFF (BOOTH 49)

REF 1. LEAD, EEAP, RSH, 1981, VOL 2, PROJ-H, CALC. pg V-6

CURRENT ENERGY CONSUMPTION

ELECTRICITY

ASSUME: FLOW = 44,000 CFM (REF. 1)
ΔP DUCTWORK & BAGS = 5 IN.W.G.
η FAN & MOTOR = .6

$$FAN\ HP = \frac{ACFM \times S.P.}{6356 \times \eta} = \frac{44000 \times 5.0}{6356 \times .6} = 58\ HP$$

$$KW = .746 \times HP = 43\ KW$$

ENERGY CONSUMED.

ASSUME: 3 SHIFT/day, 5d/wk

43 KW x 24 hr/d x 5 d/wk x 52 wk/yr = 268,000 kwhr./yr
916 mBTU/yr

COST OF ENERGY

916 mBTU/yr x $10.94/mBTU = $10,000/yr.

SAVINGS

ASSUME: BLASTING OCCURS FOR ON-1/2 TIME

ENERGY

916 mBTU/yr x .5 = 458 mBTU/yr (elec.)

COSTS

458 mBTU/yr x $10.94/mBTU = $5010/yr

RS&H

SUBJECT LEAD ECO #11 AEP NO

SHEET 2 OF 5

DESIGNER DATE

CHECKER DATE

ECO - 11 (CONT)

BLAST BOOTH FAN SHUT-OFF (BOOTH 50)

REF 2: LEAD, EEAP, RSH, 1981. VOL 2, PROJ-H, CALC. pg VI-1

CURRENT ENERGY CONSUMPTION

ASSUME: FLOW = 56,000 CFM (REF 2)

$\Delta P$ DUCT & BAGS = 5 IN. W.C.

$\eta$ FAN & MOTOR = 0.6

$$\text{FAN HP} = \frac{\text{ACFM} \times \text{S.P.}}{6356 \times \eta} = \frac{56{,}000 \times 5}{6356 \times 0.6} = 73.4 \text{ HP}$$

$$\text{KW} = .746 \text{ KW/HP} \times \text{HP} = .746 \times 73.4 = 54.8 \text{ kw}$$

ENERGY CONSUMED

ASSUME 3 SHIFT/day, 5d/wk, 52wk/yr

$$54.8 \text{ kw} \times 24 \text{ H/d} \times 5 \text{d/wk} \times 52 \text{wk/yr} = 342{,}000 \text{ kwh/yr.}$$

$$342{,}000 \text{ kw h/yr} \times \frac{3413 \text{ Btu/kwh}}{10^6 \text{ Btu/mBtu}} = 1170 \text{ mBtu/yr}$$

$1170 * 10.94 = \underline{\$12{,}800/\text{yr}}$

SAVINGS

ASSUME BLASTING OCCURS FOR 1/2 TIME

ENERGY

$1170 \text{ mBtu/yr} \times 0.5 = \underline{583} \text{ mBtu/yr (elec.)}$

COST

$583 \text{ mBtu/yr} \times \$10.94/\text{mBtu} = \$6380/\text{yr}$

RS&H

SUBJECT LEAD ECO #11

AEP NO

SHEET 3 OF 5

DESIGNER

DATE

CHECKER

DATE

ECO -11 (CONT

BLAST BOOTH FAN SHUT-OFF (BOOTH 2544)

REF 3 : LEAD, FEAP, RSH, 1981, VOL. 2, PROJ- H, CALC. pg VII-1

CURRENT ENERGY CONSUMPTION

ASSUME: FLOW = 44,000 CFM (REF 3)

$\Delta P$ DUCT & BAGS = 5 IN. W.C.

$\eta$ FAN & MOTOR = 0.6

VALUES ARE SAME AS BOOTH 49 (pg. II-1) SO SAVINGS WILL BE THE SAME.

Energy savings = 458 MBTU/yr (elec.)

RS&H

SUBJECT LEAD ECO #11 AEP NO

SHEET 4 OF 5

DESIGNER DATE

CHECKER DATE

ECO (CONT.)

BLAST BOOTH FAN SHUT OFF BLDG 37

REF 4: LEAD, EEAP, RSH, 1981, VOL. 2, PROJ H, CALC. pg X-1

FAN MOTOR HP = 20 (REF 4)

CURRENT ENERGY CONSUMED

ASSUME: 2 SHIFT OPERATION

$20 HP \times .746 \frac{KW}{HP} \times 16 \frac{H}{d} \times 5 \frac{d}{w} \times 52 \frac{w}{yr} = 62100 \frac{KWh}{yr}$

$62100 \frac{KWh}{yr} \times \frac{3413 \frac{BTU}{KWh}}{10^6 \frac{BTU}{MBTU}} = 212 \frac{MBTU}{yr}$

$212 * 10.94 = \$2319$

SAVINGS

ASSUME: BLASTING OCCURS ½ TIME.

ENERGY

$212 \frac{MBTU}{yr} \times 0.5 = 106 \frac{MBTU}{yr}$ ELEC

COST

$106 \frac{MBTU}{yr} \times \$10.94/MBTU = \$1160/yr$

RS&H®

SUBJECT LEAD ECO #11

DESIGNER

CHECKER

AEP NO

SHEET 5 OF 5

DATE

DATE

SUMMARY SAVINGS

| BLDG | BOOTH | ENERGY (MBTU ELEC/YR) | ENERGY COST SAVINGS ($) |
|---|---|---|---|
| 350 | 49 | 458 | 5010 |
| 350 | 50 | 583 | 6380 |
| 350 | 2544 | 458 | 5010 |
| 37 | — | 106 | 1160 |
| TOTAL | | 1,610 | 17,600 |

CONSTRUCTION COST

FOR ALL 4 BOOTHS = $6530

PAY BACK

$\frac{\$7280}{\$17600/yr} = 0.41$ YRS.

QRIP Calc's

Current energy use: $\$10,000 + \$12,300 + \$17,800 + \$2319$

$= \$37,919$

05/09/91

# ECO Construction Cost Estimate Calculations

ECO Name: Building 350 &37 blast booth fan control

ECO #: 11

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $1,150 |
| Labor | $2,850 |
| Subtotal bare costs | $4,000 |
| FICA Insurance (20% of Labor) | $570 |
| Sales Tax (6.5% of Material) | $75 |
| Subtotal | $4,645 |
| Overhead (15%) | $697 |
| Subtotal | $5,342 |
| Profit (10%) | $534 |
| Subtotal | $5,876 |
| Bond (1%) | $59 |
| Subtotal | $5,935 |
| Contingency (10%) | $594 |
| Subtotal (Construction Cost Input For LCCID *) | $6,529 |
| SIOH (5.5% of Construction Cost) | $359 |
| Subtotal | $6,888 |
| Design (6% of Construction Cost) | $392 |
| Total Project Cost | $7,280 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

# CONSTRUCTION COST ESTIMATE

DATE PREPARED

SHEET OF

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: Letterkenny Army Depot

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.

ESTIMATOR: G. F.

CHECKED BY: P. Hutchins

AUTO SHUT DOWN BLAST BOOTH FANS. SUMMARY

| | QUANTITY | | LABOR | | MATERIAL | | TOTAL COST |
|---|---|---|---|---|---|---|---|
| | NO. UNITS | UNIT MEAS. | PER UNIT | TOTAL | PER UNIT | TOTAL | |
| Limit Switches | 2 | ea | 32 | 64 | 42 | 84 | 148 |
| Wire 2-14 | 2 | CLF | 26.75 | 54 | 6.22 | 12 | 66 |
| Conduit ½" ø | 200 | LF | 2.97 | 594 | .96 | 192 | 786 |
| | | | | | | | |
| Cost per Booth | | | | 712 | | 288 | 1000 |
| 4 Booths. | | | | x 4 | | x 4 | x 4 |
| | | | | 2850 | | 1150 | 4000 |

ENG FORM 150
1 AUG 59

(ER 1110-345-730))

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE . 1960 O—516140

(TRANSLUCENT)

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC QRIP

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO: HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU: US AMC
Attn: AMCMM-M
5001 Eisenhower Ave.
Alexandria, VA 22303-0001

4. FROM: Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army
6. DOD COMP CODE: A
7. COMMAND CODE: W73QKK
8. DATE: 10/9/91

9. PROJECT TITLE: Modular Personnel Offices

10. TYPE OF PROJECT (Check one): [X] QRIP [ ] OSD PIF [ ] PECIP

11. AMORTIZATION YEARS/MONTHS: 26,039 (Project Cost) + 13,600 (Average Annual Savings) X 12 (No. Mos) = 1.9 (years) or -- (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 25 yrs

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S): Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION: Install modular offices with self-contained heating and cooling systems in three warehouses (#63, 8 and 9). Reset open area thermostats from 68°F to 55°F.

18. DETAILED JUSTIFICATION: Installing modular offices in storage warehouses will allow the occupants to decrease the space heating temperatures in open storage areas while maintaining higher comfort levels in the modular offices. This action will save heating fuel oil.

19. SAVINGS DISPOSITION: Savings are used to reduce energy expenditures.

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* Electricity and #2 fuel oil | $36,100 | $22,500 | $22,500 | $22,500 | $22,500 | $13,600 | $13,600 | $13,600 | $13,600 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* _____ | | | | | | | | | |
| TOTALS | $36,100 | $22,500 | $22,500 | $22,500 | $22,500 | $13,600 | $13,600 | $13,600 | $13,600 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 26,039 by average annual savings $13,600 = 1.9 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 65 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 13,600 X discount factor 9,524 = 129,500 and divide by present value of investment *(undiscounted)* 26,039 = 5.0 S/I.

(Based on economic life 25 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*



*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE<br>a | PROPOSED SOURCE OF PROCUREMENT<br>b | UNIT PRICE<br>c | QUANTITY<br>d | TOTAL COST<br>e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT<br>f | FY FUNDS REQUIRED<br>g |
|---|---|---|---|---|---|---|
| (1) Modular Offices | | $8,680 | 3 | $26,039 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION *(Equipment delivery)* | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER *(Specify)*: | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $26,039 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $26,039 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL *(Sum of (14) + (15) above)* | | | | $26,039 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

*Page 3 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g. CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) #2 Fuel Oil | | | $13,800 | | | | | | |
| (9) Electricity | | | -200 | | | | | | |
| (10) | | | | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $13,800 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

*Page 4 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

*(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)*

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

| | | |
|---|---|---|
| 25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY *(MACOM/Agency)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

*FOR USE BY HQDA ON OSD PIF PROJECTS ONLY*

| | | |
|---|---|---|
| 27. APPROVED BY | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

28. OTHER REMARKS *(Cont'd)*

*Page 5 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 15

MODULAR OFFICES IN BUILDINGS 6 SOUTH, 8 AND 9

## Discussion

The temperature in these warehouses is maintained at 68°F (and higher) primarily for operator comfort. A tremendous amount of energy is required to heat the entire warehouse to 68°F. This project consists of installing modular 10 X 12 foot offices inside these warehouses, maintaining 68°F in the offices and reducing the temperature of the warehouse to 55°F. The results are shown below.

## Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

| | |
|---|---|
| Construction Cost | $23,352 |
| Annual Energy Savings (MBtu/yr) | |
| No. 2 Fuel Oil | 2,775 |
| Electricity | (20) |
| Annual Energy Cost Savings ($/yr) | $13,600 |
| SIR | 11.2 |
| Simple Payback (years) | 1.9 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO15
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #15 MODULAR OFFICES IN WAREHOUSING
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 25 YEARS PREPARED BY: W. TODD

1. INVESTMENT

| | |
|---|---|
| A. CONSTRUCTION COST | $ 23352. |
| B. SIOH | $ 1285. |
| C. DESIGN COST | $ 1402. |
| D. SALVAGE VALUE COST | -$ 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ 26039. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | -20. | $ -219. | 15.11 | -3306. |
| B. DIST | $ 4.98 | 2775. | $ 13820. | 21.31 | 294494. |
| C. RESID | $ 4.41 | 0. | $ 0. | 25.22 | 0. |
| D. NAT G | $ .00 | 0. | $ 0. | 20.70 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 15.93 | 0. |
| F. TOTAL | | 2755. | $ 13601. | | $ 291187. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 14.53 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |
| D. PROJECT NON ENERGY QUALIFICATION TEST | | |
| (1) 25% MAX NON ENERGY CALC (2F5 X .33) | $ 96092. | |
| A IF 3D1 IS = OR > 3C GO TO ITEM 4 | | |
| B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____ | | |
| C IF 3D1B IS = > 1 GO TO ITEM 4 | | |
| D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY | | |

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 13601.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 291187.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 11.18
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 1.91

REYNOLDS, SMITH AND HILLS
ARCHITECTS • ENGINEERS • PLANNERS
INCORPORATED

SUBJECT Modular Offices
LEAD
DESIGNER W.T. Todd
CHECKER P. Hutchins

AEP NO 290-0379-001
SHEET 1 OF
DATE 4/18/91
DATE Rev. 9-25-91

ECO # 15

Modular offices for personnel in Buildings 6s, 8 & 9

Assumptions:

1. The indoor temperature for these warehouses is currently maintained at 68 °F.

2. The heating for these buildings is provided by the boilers in building 8, which burn Fuel oil # 2.

3. The operation hours for these buildings are 8 hours per day, 5 days per week (2080 hrs/yr.)

4. The warehouse temperature can be reduced to 55 °F while maintaining 68 °F in the modular offices.

5. The modular offices will also be cooled to 75 °F during the summer months.

6. The average indoor temperature during the summer months is currently about 80 °F.

7. Since the wall and roof U-values and the infiltration rate do not change, the heat losses from the buildings is determined by the indoor-outdoor temperature difference and the amount of time heating is required.

## Current energy consumption:

Annual fuel oil deliveries*:

| | | |
|---|---|---|
| FY 87 | = | 71,478 gal/yr |
| FY 88 | = | 63,607 |
| FY 89 | = | 27,283 |
| FY 90 | = | 46,446 |
| Total | | 208,814 gal/4 years |

* From Letterkenny Army Depot, Fuel Consumption Report, Building 8 Boilers.

Average fuel oil consumption = $\frac{208{,}814 \text{ gal}}{4 \text{ years}}$ = 52,203 gal/yr

Buildings 6, 8 and 9 are approximately the same size so the energy use for each building is about:

52203 gal/yr ÷ 3 = 17,401 gal/yr per building

17,401 gal/yr × 0.13869 $\frac{\text{mBtu}}{\text{gal}}$ = 2413 mBtu/yr per bldg.

TOTAL USE FOR ALL BLDGS = 2413 × 3 = 7239 mBtu/yr

## Energy Savings:

Bin temperature data were used to calculate the potential energy savings when the indoor temperature is reduced from 68°F to 55°F.

From the spreadsheet calculations the sum of the (indoor temperature - average outdoor temperature) x hours of occurrence for 68°F is: 153,752 degree hours per year

This value corresponds to the total current energy use.

The degree hours for 55 °F indoor temperature is:

82,338 degree hours

$$\text{Energy savings} = \frac{153{,}572 \text{ deg hrs} - 82{,}338 \text{ deg hrs}}{153{,}572 \text{ deg hrs}} = 0.46$$

$$\text{Energy Savings} = 2413 \frac{\text{MBtu}}{\text{yr}} \times 0.46 = 1110 \frac{\text{MBtu}}{\text{yr}} \text{ ea. for bldgs. 8 \& 9}$$

Savings for bldg. 6's will be 50% of the above value since half the bldg. is offices.

Additional Energy Use:

To maintain office temperature an electric a/c and heating unit will be utilized. It's energy use is:

$Q = UA\Delta T$

$U_{wall}$:

| | | |
|---|---|---|
| air film | $R = 0.68$ | From 1989 ASHRAE Fund. |
| 1/2" hardboard | $R = 0.125 \div 1.2 = 0.10$ | |
| 3" air space | $R = 0.90$ | |
| 1/8" hard board | $R = 0.10$ | |
| air film | $R = 0.68$ | |
| | $R_T = 2.46$ | |

$$U_w = 1/R_T = 0.41 \text{ Btu/hr·ft}^2\text{·°F}$$

$U_{window} = 1.10$ Btu/hr·ft²·°F (1989 ASHRAE Fundamentals)

$U_{ceiling}$:

| | | |
|---|---|---|
| air film | $R = 0.76$ | from 1989 ASHRAE Fund. |
| 1/2" Acc. Tile | $R = 1.25$ | |
| air film | $R = 0.76$ | |
| | $R_T = 2.77$ | |

$$U_{ceiling} = 1/R_T = 0.36 \text{ Btu/hr·ft}^2\text{·°F}$$

Wall area = $A_w = (10' \times 8' + 12' \times 8') \times 2 = 352\ ft^2 - A_{wi}$

Window area = $A_{wi} = 3' \times 3' \times 6 = 54\ ft^2$

Ceiling area = $A_c = 10' \times 12' = 120\ ft^2$

$$Q = U_w \times A_w \times \Delta T + U_{wi} \times A_{wi} \times \Delta T + U_c \times A_c \times \Delta T$$

$\Delta T_w = 68°F - 55°F = 13°F$ winter

$\Delta T_s = 80°F - 75°F = 5°F$ Summer

$$Q = (0.41 \times 298 + 1.10 \times 54 + 0.36 \times 120)\ Btu/hr \cdot °F \times \Delta T$$

$$Q_s = 224.8\ \frac{Btu}{hr \cdot °F} \times 5°F = 1124\ Btu/hr$$

$$Q_w = 224.8\ \frac{Btu}{hr \cdot °F} \times 13°F = 2922\ Btu/hr$$

Heating hours = 1,465 hours/year (from bin data)

Heating energy = $1465\ hr/yr \times 2922\ Btu/hr = \underline{4.3\ mBtu/yr}$

$$4.3\ \frac{mBtu}{yr} \times 10.94\ \$/mBtu = \underline{\$47/year}$$

Cooling hours = $9\ hr/day \times 260\ day/yr - 1465\ hr/yr = 875\ hr/yr$

Cooling efficiency: assume an EER of 8 Btu/watt

Cooling energy = $1124\ Btu/hr + 1500w \times \frac{3.413\ Btu/hr}{w}$ (appliance & people loads) $= 6224\ \frac{Btu}{hr \cdot Bld}$

Cooling energy = $6244\ Btu/hr \div 8\ \frac{Btu}{w} \times \frac{1\ kw}{1000w} \times 875\ hr/yr = 683\ kwh/yr \cdot Bldg$

Cooling energy = $683 \frac{Kwh}{yr} \times \frac{3413\ Btu}{Kwh} \times \frac{MBtu}{10^6 Btu} = 2.3\ MBtu/yr.Bldg$

$2.3\ MBtu/yr \times 10.94\ \$/MBtu = \$25/yr.Bldg.$

Total additional energy use = $\left(4.3 \frac{MBtu}{yr.B} + 2.3 \frac{MBtu}{yr.B}\right) \times 3\ Bld. = 20 \frac{MBtu}{yr}$

Total additional energy cost = $\left(47 \frac{\$}{yr.B} + 25 \frac{\$}{yr.B}\right) \times 3\ Bldg. = \$216/yr$

Energy Cost Savings:

$1110 \frac{MBtu}{yr} \times 4.98\ \$/MBtu = \$5528/yr$ for bldgs. 8 & 9

$1110 \frac{MBtu}{yr} \times 4.98\ \$/MBtu \times 0.5 = \$2764/yr$ for bldg 6 s

Net Energy Savings:

#2 Fuel oil : $1110 \frac{MBtu}{yr.Bl.} \times 2.5\ Bl. =$ 2775 MBtu/yr
Elec : $(4.3 + 2.3) \times 3 =$ (20) MBTu/yr

Net Energy Savings = Energy Savings - Add. energy use

= 2,775 MBtu/yr - 20 MBtu/yr

= 2,755 MBtu/yr

Net Energy Cost Savings:

Net energy cost savings = \$5528/yr * 2.5 Bldgs. - \$216/yr

= \$13,600/yr

## Project Cost :

Total Project Cost = #26,037

See cost estimate sheets for details

## Simple Payback :

Payback = Cost ÷ Savings

= #26,037 ÷ #13,600/yr

Payback = 1,9 years

## QRIP Calc.s

Present energy use = 7239 MBTu/yr #2 fuel oil

cost = 7239 × 4.98 = #36,100/yr

Proposed method = 4464 MBtu/yr #2 fuel oil
20 MBtu/yr electricity

cost = 4,464 × 4.98 + 20 × 10.94
= #22,500

ENERGY AUDIT OF INDUSTRIAL FACILITIES
LETTERKENNY ARMY DEPOT

Operation hours per day = 24
Operation days per week = 7

Indoor Air Temperature (F) = 55

Hour Fractions: 1 AM - 9 AM 1
9 AM - 5 PM 1
5 PM - 1 AM 1

| Temperature Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Net Hours | Delta T | Total Deg Hrs | Net Deg Hrs |
|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 785 | -17 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 791 | -12 | 0 | 0 |
| 60 | 64 | 269 | 196 | 236 | 701 | -7 | 0 | 0 |
| 55 | 59 | 249 | 191 | 209 | 649 | -2 | 0 | 0 |
| 50 | 54 | 221 | 193 | 202 | 616 | 3 | 1,848 | 1,848 |
| 45 | 49 | 218 | 193 | 206 | 617 | 8 | 4,936 | 4,936 |
| 40 | 44 | 237 | 236 | 239 | 712 | 13 | 9,256 | 9,256 |
| 35 | 39 | 289 | 246 | 286 | 821 | 18 | 14,778 | 14,778 |
| 30 | 34 | 304 | 194 | 258 | 756 | 23 | 17,388 | 17,388 |
| 25 | 29 | 184 | 106 | 152 | 442 | 28 | 12,376 | 12,376 |
| 20 | 24 | 124 | 65 | 90 | 279 | 33 | 9,207 | 9,207 |
| 15 | 19 | 75 | 32 | 57 | 164 | 38 | 6,232 | 6,232 |
| 10 | 14 | 54 | 13 | 26 | 93 | 43 | 3,999 | 3,999 |
| 5 | 9 | 18 | 3 | 9 | 30 | 48 | 1,440 | 1,440 |
| 0 | 4 | 9 | 0 | 2 | 11 | 53 | 583 | 583 |
| -5 | -1 | 3 | 0 | 1 | 4 | 58 | 232 | 232 |
| -10 | -6 | 1 | 0 | 0 | 1 | 63 | 63 | 63 |
| -15 | -11 | 0 | 0 | 0 | 0 | 68 | 0 | 0 |
| Totals | | 2798 | 2122 | 2552 | 7472 | | 82338 | 82338 |

Total operation hours while heating
corrected for working days/week = 4546 Hours/Yr

Total degree hours per year corrected for
working days per week = 82338 Degree hours

Average outdoor temperature while heating = 36.9 F

05/14/91

ECO Construction Cost Estimate
Calculations

ECO Name: Modular Offices For Buildings 6-South, 8 and 9

ECO #: 15

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $14,385 |
| Labor | $1,080 |
| Subtotal bare costs | $15,465 |
| FICA Insurance (20% of Labor) | $216 |
| Sales Tax (6.5% of Material) | $935 |
| Subtotal | $16,616 |
| Overhead (15%) | $2,492 |
| Subtotal | $19,108 |
| Profit (10%) | $1,911 |
| Subtotal | $21,019 |
| Bond (1%) | $210 |
| Subtotal | $21,229 |
| Contingency (10%) | $2,123 |
| Subtotal (Construction Cost Input For LCCID *) | $23,352 |
| SIOH (5.5% of Construction Cost) | $1,284 |
| Subtotal | $24,636 |
| Design (6% of Construction Cost) | $1,401 |
| Total Project Cost | $26,037 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED 4/19/91 | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: LetterKenny Army Depot

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- [x] CODE A (No design completed)
- [ ] CODE B (Preliminary design)
- [ ] CODE C (Final design)
- [ ] OTHER (Specify)

DRAWING NO.:

ESTIMATOR: W. T. Todd

CHECKED BY:

| Modular Office SUMMARY | QUANTITY NO. UNITS | QUANTITY UNIT MEAS. | LABOR PER UNIT | LABOR TOTAL | MATERIAL PER UNIT | MATERIAL TOTAL | TOTAL COST |
|---|---|---|---|---|---|---|---|
| ET-120 10'x12' in | | | | | | | |
| plant office | 3 | Ea | 160 | 480 | 4395 | 13185 | |
| Shipping from Florida | 3 | Ea | — | — | 250 | 750 | |
| Electric wiring | 3 | Ea | 200 | 600 | 150 | 450 | |
| | | | | | | | |
| Sub total | | | | 1080 | | 14,385 | #15,465 |

ENG FORM 150
1 AUG 59

(ER 1110-345-730)

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE : 1959 O—516168

(TRANSLUCENT)

GETCO, Inc.
P.O. Box 10432
Jacksonville, FL 32247-0432
(904) 791-9042 Fax: (904) 358-3906

Ship To:

REYNOLDS, SMITH & HILL
6737 SOUTHPOINT DRIVE
JAX, FL. 32216
ATTN: BILL TODD

Bill To:

Salesman: DAN
Cust Contact: BILL
Phone Number: 279-2281
Fax Number: 279-2491
Customer PO: _____

Date
Quote = ___ 4-12-91
Order = ___ _____
Inv = ___ _____

| Qty. | Unit | Stock # | Description | U | Cap. | Unit Wgt. | Total Weight | Unit List | Total List | Disc. | Unit Cost | Total Cost | Unit Sell | Total Sell |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | EA. | ET-120 10'X12' IN-PLANT | | | | | | | | | | | | |
| | | OFFICE BUILDING COMPLETE | | | | | | | | | | | | |
| | | WITH THE FOLLOWING: | | | | | | | | | | | | |
| | | 1-STD. DOOR, 6-WINDOWS, | | | | | | | | | | | | |
| | | 1-HVAC UNIT, 4-110V OUTLETS, | | | | | | | | | | | | |
| | | 1-220V OUTLETS, 1-LIGHT SWITCH | | | | | | | | | | | | |
| | | 2-4 TUBE FLUORESCENT FIXTURES, | | | | | | | | | | | | |
| | | 1-4 CIRCUIT BREAKER BOX | | | | | | | $4469.00 | | | | | $4395.00 |
| | | | | | | | | | | | | | | |
| | | ABOVE PRICE F.O.B. HIALEAH, FL. | | | | | | | | | | | | |
| | | ALLOW 2 WKS A.R.O. DELIVERY | | | | | | | | | | | | |
| | | | | | | | | | | | | | | |
| | | Delivery Charges | | | | | | | | | | | | |

T.W. _____ T.L. _____

*New and Used Warehouse Equipment*
*Sales and Service*

**GETCO, INC.**

**Dan Caswell**

P.O. Box 10432
Jacksonville, Florida 32247-0432
(904) 791-9042

1780 W. Beaver St.
Jacksonville, Florida 32209

ENERGY AUDIT OF INDUSTRIAL FACILITIES
LETTERKENNY ARMY DEPOT

Operation hours per day = 24
Operation days per week = 7

Indoor Air Temperature (F) = 60

Hour Fractions: 1 AM - 9 AM 1
9 AM - 5 PM 1
5 PM - 1 AM 1

| Temperature Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Net Hours | Delta T | Total Deg Hrs | Net Deg Hrs |
|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 785 | -12 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 791 | -7 | 0 | 0 |
| 60 | 64 | 269 | 196 | 236 | 701 | -2 | 0 | 0 |
| 55 | 59 | 249 | 191 | 209 | 649 | 3 | 1,947 | 1,947 |
| 50 | 54 | 221 | 193 | 202 | 616 | 8 | 4,928 | 4,928 |
| 45 | 49 | 218 | 193 | 206 | 617 | 13 | 8,021 | 8,021 |
| 40 | 44 | 237 | 236 | 239 | 712 | 18 | 12,816 | 12,816 |
| 35 | 39 | 289 | 246 | 286 | 821 | 23 | 18,883 | 18,883 |
| 30 | 34 | 304 | 194 | 258 | 756 | 28 | 21,168 | 21,168 |
| 25 | 29 | 184 | 106 | 152 | 442 | 33 | 14,586 | 14,586 |
| 20 | 24 | 124 | 65 | 90 | 279 | 38 | 10,602 | 10,602 |
| 15 | 19 | 75 | 32 | 57 | 164 | 43 | 7,052 | 7,052 |
| 10 | 14 | 54 | 13 | 26 | 93 | 48 | 4,464 | 4,464 |
| 5 | 9 | 18 | 3 | 9 | 30 | 53 | 1,590 | 1,590 |
| 0 | 4 | 9 | 0 | 2 | 11 | 58 | 638 | 638 |
| -5 | -1 | 3 | 0 | 1 | 4 | 63 | 252 | 252 |
| -10 | -6 | 1 | 0 | 0 | 1 | 68 | 68 | 68 |
| -15 | -11 | 0 | 0 | 0 | 0 | 73 | 0 | 0 |
| Totals | | 2798 | 2122 | 2552 | 7472 | | 107015 | 107015 |

Total operation hours while heating
corrected for working days/week = 5195 Hours/Yr

Total degree hours per year corrected for
working days per week = 107015 Degree hours

Average outdoor temperature while heating = 39.4 F

ENERGY AUDIT OF INDUSTRIAL FACILITIES
LETTERKENNY ARMY DEPOT

Operation hours per day = 24
Operation days per week = 7

Indoor Air Temperature (F) = 68

Hour Fractions: 1 AM - 9 AM 1
9 AM - 5 PM 1
5 PM - 1 AM 1

| Temperature Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Net Hours | Delta T | Total Deg Hrs | Net Deg Hrs |
|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 785 | -4 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 791 | 1 | 791 | 791 |
| 60 | 64 | 269 | 196 | 236 | 701 | 6 | 4,206 | 4,206 |
| 55 | 59 | 249 | 191 | 209 | 649 | 11 | 7,139 | 7,139 |
| 50 | 54 | 221 | 193 | 202 | 616 | 16 | 9,856 | 9,856 |
| 45 | 49 | 218 | 193 | 206 | 617 | 21 | 12,957 | 12,957 |
| 40 | 44 | 237 | 236 | 239 | 712 | 26 | 18,512 | 18,512 |
| 35 | 39 | 289 | 246 | 286 | 821 | 31 | 25,451 | 25,451 |
| 30 | 34 | 304 | 194 | 258 | 756 | 36 | 27,216 | 27,216 |
| 25 | 29 | 184 | 106 | 152 | 442 | 41 | 18,122 | 18,122 |
| 20 | 24 | 124 | 65 | 90 | 279 | 46 | 12,834 | 12,834 |
| 15 | 19 | 75 | 32 | 57 | 164 | 51 | 8,364 | 8,364 |
| 10 | 14 | 54 | 13 | 26 | 93 | 56 | 5,208 | 5,208 |
| 5 | 9 | 18 | 3 | 9 | 30 | 61 | 1,830 | 1,830 |
| 0 | 4 | 9 | 0 | 2 | 11 | 66 | 726 | 726 |
| -5 | -1 | 3 | 0 | 1 | 4 | 71 | 284 | 284 |
| -10 | -6 | 1 | 0 | 0 | 1 | 76 | 76 | 76 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 0 | 0 |
| Totals | | 2798 | 2122 | 2552 | 7472 | | 153572 | 153572 |

Total operation hours while heating
corrected for working days/week = 6687 Hours/Yr

Total degree hours per year corrected for
working days per week = 153572 Degree hours

Average outdoor temperature while heating = 45.0 F

ENERGY AUDIT OF INDUSTRIAL FACILITIES
LETTERKENNY ARMY DEPOT

Operation hours per day = 8
Operation days per week = 5

Indoor Air Temperature (F) = 68

Hour Fractions:
1 AM - 9 AM 0.25
9 AM - 5 PM 0.75
5 PM - 1 AM 0

| Temperature Range | | Hours of Occurrence 2-9 | 10-17 | 18-1 | Net Hours | Delta T | Total Deg Hrs | Net Deg Hrs |
|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 240 | -4 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 237 | 1 | 791 | 237 |
| 60 | 64 | 269 | 196 | 236 | 214 | 6 | 4,206 | 1,286 |
| 55 | 59 | 249 | 191 | 209 | 206 | 11 | 7,139 | 2,261 |
| 50 | 54 | 221 | 193 | 202 | 200 | 16 | 9,856 | 3,200 |
| 45 | 49 | 218 | 193 | 206 | 199 | 21 | 12,957 | 4,184 |
| 40 | 44 | 237 | 236 | 239 | 236 | 26 | 18,512 | 6,143 |
| 35 | 39 | 289 | 246 | 286 | 257 | 31 | 25,451 | 7,959 |
| 30 | 34 | 304 | 194 | 258 | 222 | 36 | 27,216 | 7,974 |
| 25 | 29 | 184 | 106 | 152 | 126 | 41 | 18,122 | 5,146 |
| 20 | 24 | 124 | 65 | 90 | 80 | 46 | 12,834 | 3,669 |
| 15 | 19 | 75 | 32 | 57 | 43 | 51 | 8,364 | 2,180 |
| 10 | 14 | 54 | 13 | 26 | 23 | 56 | 5,208 | 1,302 |
| 5 | 9 | 18 | 3 | 9 | 7 | 61 | 1,830 | 412 |
| 0 | 4 | 9 | 0 | 2 | 2 | 66 | 726 | 149 |
| -5 | -1 | 3 | 0 | 1 | 1 | 71 | 284 | 53 |
| -10 | -6 | 1 | 0 | 0 | 0 | 76 | 76 | 19 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 0 | 0 |
| Totals | | 2798 | 2122 | 2552 | 2291 | | 153572 | 46172 |

Total operation hours while heating corrected for working days/week = 1465 Hours/Yr

Total degree hours per year corrected for working days per week = 32980 Degree hours

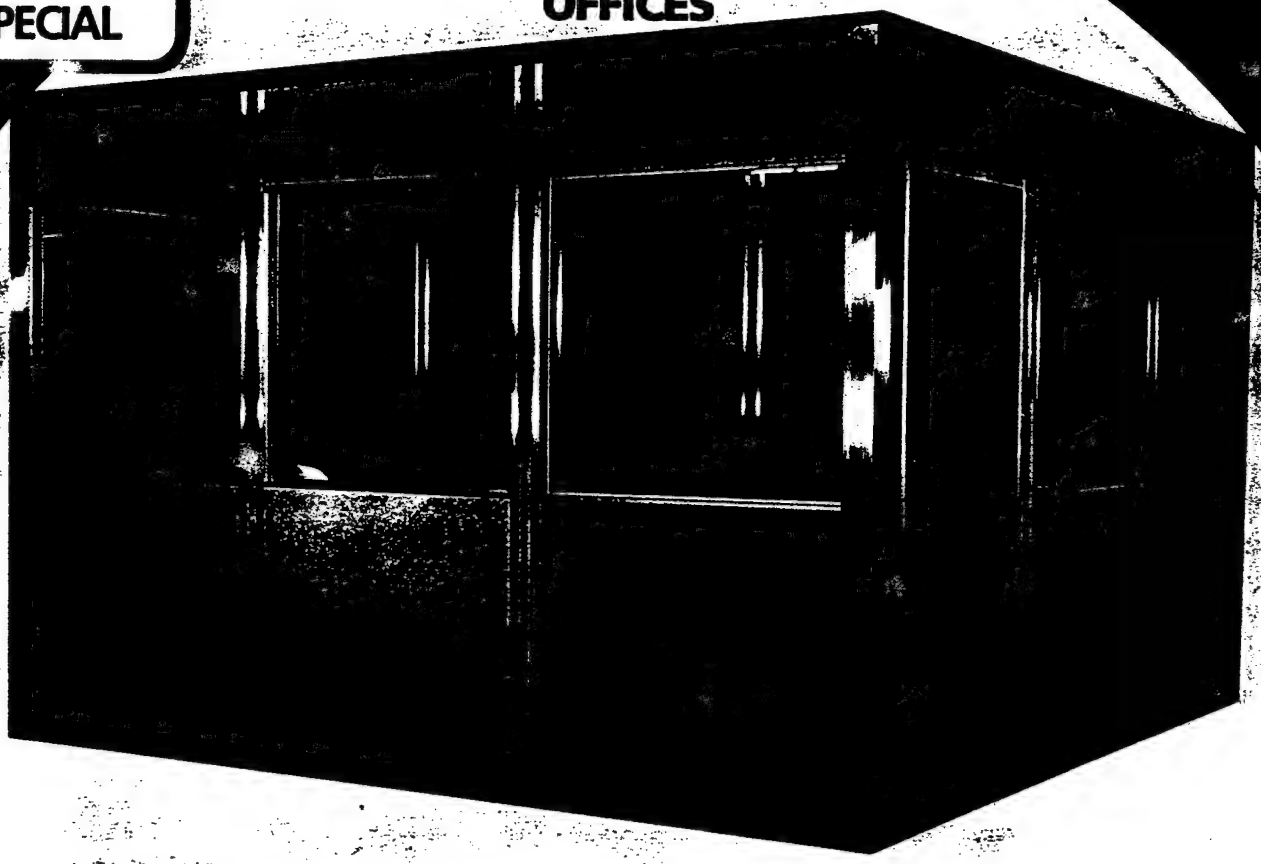
Average outdoor temperature while heating = 45.0 F

LETTERKENNY ARMY DEPOT
FUEL CONSUMPTION REPORT
IN GALLONS

| BLDG | YEAR | OCT | NOV | DEC | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | YEARLY TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ** BOILER LOCATION: BUILDING 1 | | | | | SERVES BUILDINGS: 1, 2 | | | | | | | | | FUEL TYPE: 5 |
| 1 | FY87 | 4545 | 2640 | 728 | 2810 | 3401 | 6278 | 10899 | 6000 | 17985 | 2112 | 3989 | 8052 | 69439 |
| 1 | FY88 | 0 | 21786 | 9197 | 4575 | 16052 | 4647 | 10351 | 225 | 2472 | 0 | 0 | 0 | 69305 |
| 1 | FY89 | 294 | 5623 | 9885 | 2697 | 16802 | 3138 | 10534 | 706 | 91 | 1321 | 1027 | 4165 | 56283 |
| 1 | FY90 | 6864 | 10838 | 851 | 8832 | 15574 | 2377 | -1 | 4007 | 0 | 1386 | 378 | 0 | 51106 |
| ** BOILER LOCATION: BUILDING 2 | | | | | SERVES BUILDINGS: 4, 7 | | | | | | | | | FUEL TYPE: 2 |
| 2 | FY87 | 896 | 732 | 4206 | 9777 | 9384 | 8246 | 2710 | 2636 | 3836 | 3636 | 2916 | 190 | 49165 |
| 2 | FY88 | 8018 | 943 | 10711 | 12793 | 27167 | 15963 | 12033 | 8226 | 4936 | 21796 | 4113 | 1233 | 127932 |
| 2 | FY89 | 2112 | 6053 | 602 | 2783 | 11941 | 1044 | 10607 | 1107 | 0 | 0 | 0 | 0 | 36249 |
| 2 | FY90 | 5131 | 14811 | 17118 | 20647 | 4276 | 4882 | 2137 | 0 | 0 | 1220 | 4410 | 0 | 74632 |
| ** BOILER LOCATION: BUILDING 3 | | | | | SERVES BUILDINGS: 3, 5 | | | | | | | | | FUEL TYPE: 5 |
| 3 | FY87 | 756 | 6275 | 908 | 6695 | 15 | 1361 | 1931 | 2617 | 4275 | 8198 | 15139 | 5951 | 54121 |
| 3 | FY88 | 3368 | 6455 | 13284 | 11511 | 3649 | 7043 | 4445 | 6164 | 392 | 0 | 0 | 0 | 56311 |
| 3 | FY89 | 0 | 12449 | 4999 | 4672 | 17211 | 5886 | 2140 | 1230 | 0 | 179 | 228 | 1266 | 50260 |
| 3 | FY90 | 3787 | 1852 | 2154 | 7188 | 11293 | 4493 | -1 | 0 | 0 | 0 | 0 | 0 | 30766 |
| ** BOILER LOCATION: BUILDING 8 | | | | | SERVES BUILDINGS: 6, 8, 9 | | | | | | | | | FUEL TYPE: 2 |
| 8 | FY87 | 1088 | 7035 | 13054 | 16931 | 13780 | 9278 | 9475 | 163 | 0 | 0 | 123 | 551 | 71478 |
| 8 | FY88 | 0 | 8435 | 10865 | 1249 | 24192 | 0 | 4246 | 77 | 0 | 3544 | 3534 | 7465 | 63607 |
| 8 | FY89 | 9612 | 4042 | 2798 | 4808 | 446 | 4719 | 336 | 522 | 0 | 0 | 0 | 0 | 27283 |
| 8 | FY90 | 3614 | 8846 | 9613 | 11906 | 7665 | 1679 | 3123 | 0 | 0 | 0 | 0 | 0 | 46446 |
| ** BOILER LOCATION: BUILDING 10 | | | | | SERVES BUILDINGS: 10 | | | | | | | | | FUEL TYPE: 2 |
| 10 | FY87 | 254 | 66 | 77 | 96 | 129 | 65 | 106 | 83 | 0 | 356 | 250 | 0 | 1482 |
| 10 | FY88 | 530 | 1177 | 4509 | 3631 | 2993 | 3240 | 637 | 619 | 0 | 206 | 121 | 58 | 17721 |
| 10 | FY89 | 103 | 1982 | 3918 | 4290 | 2413 | 2534 | 910 | 215 | 0 | 300 | 2703 | 500 | 19868 |
| 10 | FY90 | 0 | 1315 | 4433 | 4942 | 2225 | 789 | 0 | 0 | 0 | 0 | 0 | 0 | 13704 |
| ** BOILER LOCATION: BUILDING 12 | | | | | SERVES BUILDINGS: 12, 13, 14 | | | | | | | | | FUEL TYPE: 5 |
| 12 | FY87 | 1794 | 1732 | 833 | 2938 | 4103 | 2987 | 961 | 31 | 62 | 4 | 92 | 184 | 15721 |
| 12 | FY88 | 369 | 2414 | 3949 | 4405 | 3537 | 2370 | 1547 | 131 | 0 | 0 | 0 | 0 | 18722 |
| 12 | FY89 | 800 | 2507 | 4263 | 2818 | 3824 | 2596 | 789 | 269 | 0 | 0 | 0 | 0 | 17866 |
| 12 | FY90 | 675 | 3428 | 2929 | 1432 | 2430 | 3067 | 521 | 0 | 0 | 0 | 0 | 0 | 14482 |
| ** BOILER LOCATION: BUILDING 37HP | | | | | SERVES BUILDINGS: 37 | | | | | | | | | FUEL TYPE: 2 |
| 37HP | FY87 | 3506 | 3583 | 2147 | 6008 | 4366 | 3582 | 3763 | 4823 | 1153 | 5113 | 3037 | 5424 | 46505 |
| 37HP | FY88 | 4633 | 4840 | 5453 | 6893 | 6583 | 7643 | 2435 | 5611 | 6266 | 7803 | 2280 | 6856 | 67296 |
| 37HP | FY89 | 2625 | 5712 | 6551 | 6816 | 8100 | 5837 | 5824 | 1110 | 1108 | 3660 | 6957 | 3379 | 57679 |
| 37HP | FY90 | 5486 | 9712 | 5367 | 4934 | 5666 | 9263 | 8553 | 1012 | 0 | 0 | 0 | 0 | 49993 |
| ** BOILER LOCATION: BUILDING 37N | | | | | SERVES BUILDINGS: 37 | | | | | | | | | FUEL TYPE: 5 |
| 37N | FY87 | 101 | 1477 | 4097 | 4079 | 4300 | 3586 | 1307 | 155 | 0 | 0 | 40 | 40 | 19182 |
| 37N | FY88 | 731 | 3099 | 1571 | 2750 | 10474 | 4706 | 4820 | 156 | 312 | 624 | 1248 | 960 | 31451 |
| 37N | FY89 | 1920 | 1951 | 266 | 3412 | 4256 | 3531 | 1084 | 123 | 0 | 0 | 0 | 0 | 16543 |
| 37N | FY90 | 1553 | 5008 | 7038 | 1798 | 2996 | 5695 | 1079 | 0 | 0 | 0 | 0 | 0 | 25167 |

**TIGER SPECIAL**

# ECONO-THREE OFFICES



National ECONO-THREE modular in-plant offices are designed for applications where cost is a major consideration.

Although low in price, these attractive enclosures offer full 3" thick, 3-ply wall panels constructed of ⅛" 4 mil vinyl-clad hardboard (each side) over a kraft honeycomb core. All panels are completely interchangeable and reuseable.

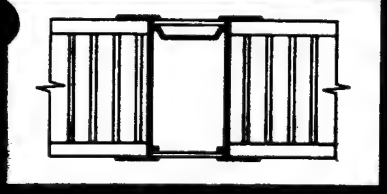
Features include pre-hung, pre-finished oak woodgrain doors, pre-painted steel-ribbed roof deck and one-piece mill-finished extruded aluminum connection and corner posts allowing fast on-site assembly.

System incorporates all of National's quality features including exclusive "Wire-Pak" modular snap-together, six-wire wiring system. Offices are also available in vision tower and two-story versions.

SEE PAGES 16 THROUGH 19 FOR CONSTRUCTION DETAILS.

SEE PAGE 26 FOR ARCHITECTURAL SPECIFICATIONS.

15-14



**MODEL SELECTION CHART**

| | | | | | |
|---|---|---|---|---|---|
| ET64 | 8x8 | 958 | ET320 | 16x20 | 2734 |
| ET80 | 8x10 | 1012 | ET336 | 12x28 | 2966 |
| ET96 | 8x12 | 1246 | ET384 | 12x32 | 3310 |
| ET100 | 10x10 | 1260 | ET388 | 16x24 | 3148 |
| ET120 | 10x12 | 1418 | ET400 | 20x20 | 3190 |
| ET144 | 12x12 | 1590 | ET448 | 16x28 | 3534 |
| ET160 | 10x16 | 1734 | ET480 | 20x24 | 3646 |
| ET192 | 12x16 | 1934 | ET512 | 16x32 | 3934 |
| ET200 | 10x20 | 2050 | ET560 | 20x28 | 4102 |
| ET240 | 12x20 | 2278 | ET640 | 20x32 | 4558 |
| ET256 | 16x16 | 2334 | ET720 | 20x36 | 5014 |
| ET288 | 12x24 | 2622 | ET800 | 20x40 | 5470 |

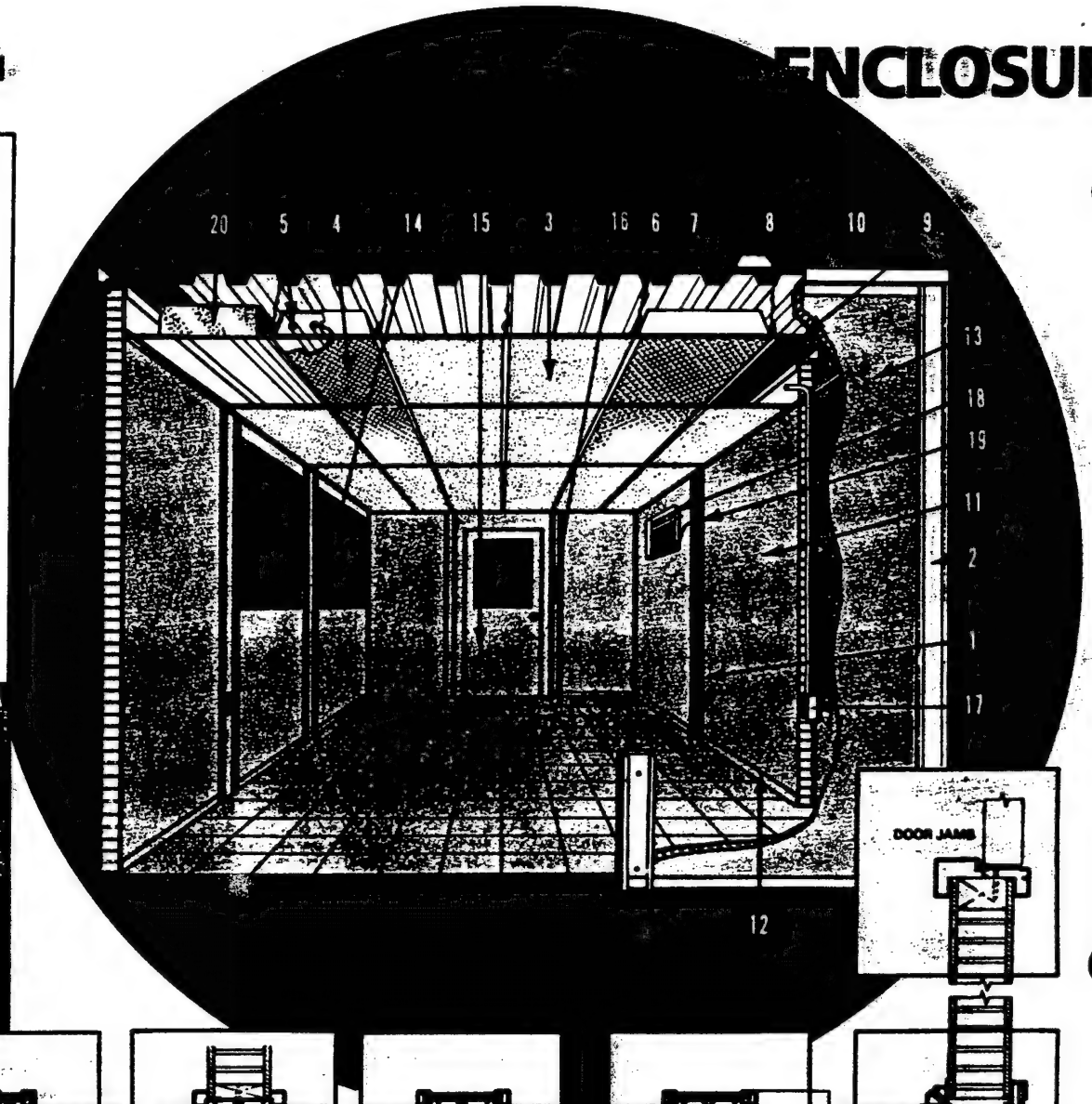
# ENCLOSUF

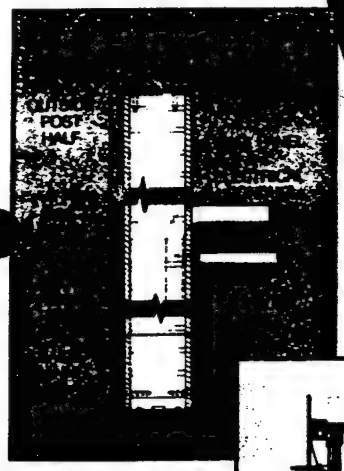
**NATIONAL'S VERSATILE**

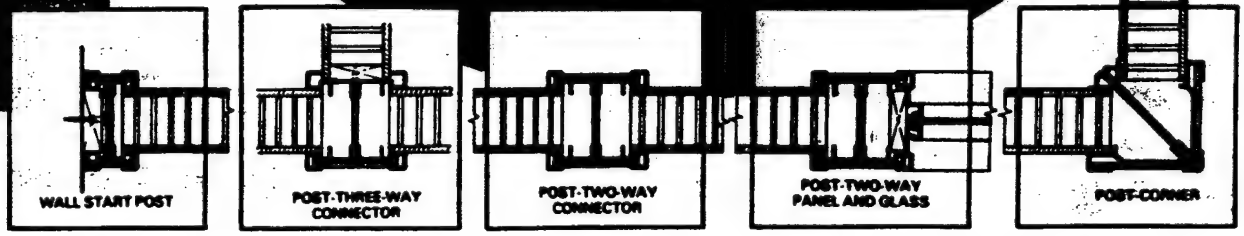
**V10™ POST system**

**IS A UNIQUE STRUCTURAL CONCEPT THAT SERVES AS THE KEY ELEMENT OF NATIONAL'S MODULAR BUILDING SYSTEMS.**

The V10 Post System was specially designed to be used in ten different ways: 1) as a wall start; 2) as a finished end; 3) as an in-line post; 4) as a 3-way post; 5) as a 4-way post; 6) as a corner post; 7) as an electrical raceway; 8) as a housing for steel inserts; 9) as a battan strip; 10) as a shelf standard when pierced.




1. **POSTS:** Extruded anodized aluminum with spring-held vinyl-clad feature strips to match interior/exterior panel facings (see V10™ information above).
2. **CORNER POSTS:** Massive two-piece anodized aluminum with matching vinyl-clad feature strips assure fastest possible assembly of corners.
3. **CEILING:** Attractive, white, random fissured, vinyl-faced fiberglass tile, easily cleaned to retain permanent beauty.
4. **INDIRECT LIGHTING:** Luminous fixture panels, as required, provide efficient, soft overall lighting without dark areas.
5. **CONCEALED LIGHTS:** Fluorescent, four-tube, lay-in troffer-type fixtures. Average 100 foot candles of illumination.
6. **TIE WIRES:** Fasten to roof deck with self-tapping screws and to ceiling grid main T's.
7. **ROOF DECK:** Designed to achieve optimum structural efficiency in 22 gauge steel (painted), provides clear spans up to 12 feet (20 feet with 6-inch joists).
8. **ROOF DECK END CLOSURES:** Rubber seals inserted in roof flutes contain heat and conditioned air. Insures dust-free interior.
9. **CEILING GRID:** White enameled "T" support system forms a rigid frame for light fixtures and ceiling tiles.
10. **PANEL CAPS:** Anodized aluminum panel caps incorporating fascia provide finishing touch to panels as seen from exterior.
11. **WALLS:** A full 3-inch thick with honeycomb core affords structural rigidity and effective "Sound Conditioning." 3/16" tempered hardboard facings, clad in choice of "DIAMOND-COAT" vinyl colors and finishes, retain beauty with minimum maintenance.
12. **CONTINUOUS BASE CHANNEL:** Heavy anodized aluminum base channel (fastened to floor) supports and secures wall panels. Trims bottom on interior and exterior.
13. **REMOVABLE PANELS:** Special design feature of panels allows easy removal providing access for large equipment, or replacement of damaged panels, without dismantling enclosure.
14. **WINDOWS:** Optional choice of picture, sliding or pass-thru (with or without shelf). All provided with tempered safety glass.
15. **DOORS:** Attractively faced in harmonizing vinyl. Pre-hung in aluminum jamb, complete with hardware, solid 20-inch by 30-inch door lite, and/or with 18-inch by 12-inch anodized aluminum grille are optional.
16. **WALL SWITCH:** Light switches are conveniently placed and attractive, conforming to National Code.
17. **WALL OUTLETS:** Conduit run with junction box, outlet or switch, cover plate offset fitting, conduit to reach ceiling plenum and connectors. All pre-assembled in interior posts to create vertical electric raceway.
18. **COMFORT CONTROL OPTIONS:** Include air conditioners (from 5,000 BTU to 12,000 BTU); 8-inch exhaust fan (wall-mounted), 180 CFM; heater up to 5,600 watts (Heat, off or fan) wall-mounted; anodized aluminum louver 12-inch by 18-inch.
19. **AIR CONDITIONER OUTLET:** 110 or 220 volt. (Breaker panel provided with the office kit allows separate circuit for air conditioner operation.)
20. **ENERGY-SAVER CONSTRUCTION (Optional):** Includes wall panels constructed of 3/16-inch vinyl-clad facings (each side) with an insulating polystyrene foam core (1 lb. density) and a 6-inch thick fiberglass blanket of insulation layed into the plenum area. Provides R-12 wall and R-19 roof rating.

**SEE PAGE 26 FOR ENGINEERING AND ARCHITECTURAL SPECIFICATIONS**

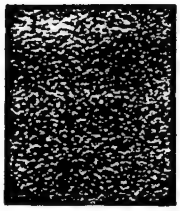
# CONSTRUCTION DETAILS

**PANEL CONSTRUCTION DETAILS**



**NOTE:**
Other facings such as (but not limited to) .032-inch aluminum, and panel cores utilizing steel studs and urethane are also available.





409-SAND

NC-251-HICKORY

**STANDARD INTERIOR PANEL FINISHES –** National offices are available in the standard vinyl finishes as shown at left. These and all optional finishes (except 801, 803 and 812 textured films) incorporate National's exclusive DIAMOND COAT™ described above.

401 SNOW WHITE | NC-159 PECAN | NC-150 WALNUT | NC-254 OAK | NC-156 ROSEWOOD | NC-157 NATURAL TEAK | 801 TAN CALCUTTA | 803 BEIGE CALCUTTA | 812 GREY CALCUTTA

**OPTIONAL INTERIOR PANEL FINISHES**
National laminates their own vinyl-clad panels and can provide the widest selection of colors and woodgrains in the industry. Cork and chaulk board facings are also available on request. Other finishes (not shown) can be supplied ... contact the factory. See actual swatch samples for exact color and finish.

# OSD PIF

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC OSD PIF

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE: Dip Tank Covers and Exhaust Fan Controls

10. TYPE OF PROJECT (Check one): ☐ QRIP ☒ OSD PIF ☐ PECIP

11. AMORTIZATION YEARS/MONTHS:
$ $210,257 (Project Cost) ÷ 137,400 (Average Annual Savings) X 12 (No. Mos)
= 1.5 (years) or - (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR: 024

13. ECONOMIC LIFE: 15

14. EXPECTED OPERATIONAL DATE:

15. SUBMITTING UNIT(S):
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE:

17. PROJECT DESCRIPTION:
Covers for dip tanks that will allow the exhaust fan speed to be reduced to provide reduced air flow requirements.

18. DETAILED JUSTIFICATION:
Covering the dip tanks will reduce the ventilation air flow requirements. The reduced air flow will save energy.

19. SAVINGS DISPOSITION:
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY (Identify) Electricity and #6 fuel oil | $209,500 | $72,100 | $72,100 | $72,100 | $72,100 | $137,400 | $137,400 | $137,400 | $137,400 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER (Identify) _____ | | | | | | | | | |
| TOTALS | $209,500 | $72,100 | $72,100 | $72,100 | $72,100 | $137,400 | $137,400 | $137,400 | $137,400 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN (IRR)

Divide estimated project cost $209,500 by average annual savings 137,400 = 1.5 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 110 % IRR.

(2) SAVINGS TO INVESTMENT RATIO (S/I)

Multiply annual savings 137,400 X discount factor 7.98 = 1,096,500 and divide by present value of investment (undiscounted) 210,257 = 5.2 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE (RIMS) N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*

Page 2 of DA Form 5108-R

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)—Continued.*

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE<br>a | PROPOSED SOURCE OF PROCUREMENT<br>b | UNIT PRICE<br>c | QUANTITY<br>d | TOTAL COST<br>e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT<br>f | FY FUNDS REQUIRED<br>g |
|---|---|---|---|---|---|---|
| (1) Dip Tank Covers | - | $1,404 | 39 | $54,765 | | |
| (2) Exhaust Fan Controls | | $7,775 | 20 | $155,492 | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION (Equipment delivery) | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER (Specify): | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $210,257 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $210,257 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL (Sum of (14) + (15) above) | | | | $210,257 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

Page 3 of DA Form 5108-R

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)—Continued.*

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) Electricity | | | $27,300 | | | | | | |
| (9) #6 Fuel Oil | | | $114,800 | | | | | | |
| (10) Cover Replacements | | | ($4,700) | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $137,400 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*



*Figure II–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

| 24. REGULATORY APPROVAL/COORDINATION | | |
|---|---|---|
| a. INVESTMENT STATEMENT<br>This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.<br>(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.) | | |
| b. OTHER COORDINATION (Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.) | | |
| 25. SUBMITTED BY (Typed name, grade and title of Subordinate Command/Agency or Project Initiator) | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY (MACOM/Agency) | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| FOR USE BY HQDA ON OSD PIF PROJECTS ONLY | | |
| 27. APPROVED BY | SIGNATURE | DATE (YYMMDD)<br>AUTOVON |
| 28. OTHER REMARKS (Cont'd) | | |

Page 5 of DA Form 5108-R

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 3

## DIP TANK COVERS WITH EXHAUST FAN CONTROLS

### Discussion

Noxious dip tank fumes are exhausted in accordance with OSHA guidelines to protect workers. Ventilation of the fumes is accomplished by drawing room air across the surface of the dip tank fluid, into an exhaust duct, through a ventilation fan and out through the roof to the atmosphere. The warm room air used to entrain the fumes must be replaced with outside air that must be heated. The exhausted air represents a significant heat loss.

The amount of exhausted air can be minimized by covering the dip tank and draft slot with a flexible, chemically resistant cover whenever the tank is not in use. With the cover in place, the fume evolution potential is sharply reduced, so the amount of exhaust air can also be reduced. The reduction in exhaust air represents substantial energy savings from both reduced warm air loss as well as from reduced exhaust fan power.

This ECO provides all vented dip tanks with a flexible, chemically resistant cover (like a tarpaulin) permanently fixed to each tank/vent-duct assembly. The cover can be extended or retracted by appropriate means ranging from manually rolling and unrolling to spring-assisted retraction, similar to the operation of a window shade (see Volume II for sketches). This ECO also provides for exhaust fan speed reduction whenever the covers are in place. The speed reduction will be accomplished by measuring and controlling a set pressure rise across the exhaust fan with a differential pressure sensor and controller which in turn will adjust the speed of the exhaust fan motor through a variable frequency drive. This fan speed control will be particularly effective in Buildings 1 and 370 where fans serve multiple tanks. With this control technique, the OSHA-mandated exhaust air flows can be maintained under all conditions of variable building pressure and variable tank use.

This approach to dip tank operation has been discussed with OSHA in Harrisburg, Pennsylvania, and determined to be acceptable.

## Recommendation

Based on the Life Cycle Cost Analysis and a discussion with OSHA, it is recommended that flexible, chemically resistant dip tank covers be installed along with vent fan pressure differential controllers on the 29 vented dip tanks as noted in the Appendix.

| | |
|---|---|
| Construction Cost | $188,590 |
| Annual Energy Savings (MBtu/yr) | |
| Nos. 5 & 6 Oil | 26,034 |
| Electricity | 2,496 |
| Annual Energy Cost Savings ($/yr) | $142,100 |
| Additional Maintenance | $4,700 |
| SIR | 10.0 |
| Simple Payback (years) | 1.5 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO3
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #3 DIP TANK COVERS
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-21-91 ECONOMIC LIFE 15 YEARS PREPARED BY: W. TODD

1. INVESTMENT

| | |
|---|---|
| A. CONSTRUCTION COST | $ 188570. |
| B. SIOH | $ 10372. |
| C. DESIGN COST | $ 11315. |
| D. SALVAGE VALUE COST | -$ 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ 210257. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 2496. | $ 27306. | 10.75 | 293542. |
| B. DIST | $ 4.98 | 0. | $ 0. | 14.08 | 0. |
| C. RESID | $ 4.41 | 26034. | $ 114810. | 16.21 | 1861069. |
| D. NAT G | $ .00 | 0. | $ 0. | 13.25 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 11.13 | 0. |
| F. TOTAL | | 28530. | $ 142116. | | $ 2154611. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ -4700. |
| (1) DISCOUNT FACTOR (TABLE A) | 10.59 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ -49773. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ -49773. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 711022.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 137416.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 2104838.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 10.01
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 1.53

RS-H

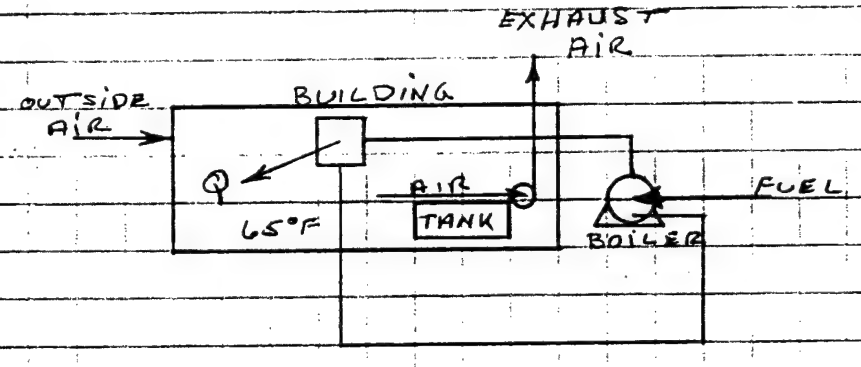
SUBJECT LETTERKENNY ERAP
ECO #3
DESIGNER G.F.
CHECKER

AEP NO 290-0379-001
SHEET 1 OF 4
DATE 3-21-91
DATE

# ECO # 3 DIP TANK COVERS

ASSUMPTIONS:

1. ROOM TEMPERATURE = 68°F
2. HEAT LOAD FACTOR (HLF)
   HLF$_1$ = 0.166 MBTU/yr·CFM (24 hr/d, 7 d/w)
   HLF$_2$ = 0.0742 MBTU/yr·CFM (16 hr/d, 5 d/w)
3. FAN EFFICIENCY = 0.5
4. STEAM GENERATION EFFICIENCY = 0.8
5. FAN $\Delta P$ = 3 IN. W.C.
6. LEAKAGE FLOW WITH COVER IN PLACE = 1% DESIGN FLOW




CURRENT ENERGY USE (TANK 4318, BLDG 37)

$$Q = \frac{\text{CFM} \times \text{HEAT LOSS FACTOR (MBTU/CFM YR)}}{\text{STEAM GEN. EFF}}$$

$$= \frac{5200 \times 0.166}{0.8} = 1079 \text{ MBTU/yr} \quad \#2 \text{ F.O.}$$

CURRENT FAN ENERGY USE

$$\text{FAN HP} \times \text{BTU/HP HR} \times 8760 \text{ HR/yr} \times \frac{\text{MBTU}}{10^6 \text{ BTU}} =$$

$$\frac{5200 \times 3}{6356 \times .5} \text{ HP} \times 2545 \text{ BTU/HP HR} \times 8760 \text{ HR/yr} \times \frac{1}{10^6} = 109 \text{ MBTU/yr}$$

ELECTRIC

RS&H

SUBJECT LETTERKENNY EEAP

DESIGNER G. F.

CHECKER

AEP NO

SHEET 2 OF 4

DATE 3-21-91

DATE

## ENERGY CONSUMPTION (W) COVER

(16-h/d, 5d/w) ..... (8-h/d 5d/w + weekends)

Q = HEAT LOSS IN OPERATION + HEAT LOSS COVERED

$$= \frac{CFM \times HLF}{\eta} + \frac{(LEAKAGE\ CFM \times (HLF_1 - HLF_2))}{\eta}$$

$$= \frac{5200 \times 0.0742}{0.8} + \frac{52 \times (0.166 - 0.0742)}{0.8} = 488\ MBTU/yR$$

## FAN ENERGY CONSUMPTION (W) COVER

NOTE: FAN $\Delta P$ CONTROLS WILL REDUCE FAN SPEED VIA A VARIABLE FREQUENCY DRIVE TO MAINTAIN SET $\Delta P$ WHEN COVER IS IN PLACE.

CONSUMPTION = ENERGY USE WHILE COVERED & UNCOVERED.

### UNCOVERED CONSUMPTION

$$= CURRENT\ FAN\ USE \times \frac{UNCOVERED\ TIME}{TOTAL\ TIME}$$

$$= 109 \times \frac{4160}{8760} = 51.76\ MBTU\ ELEC/yR$$

### COVERED CONSUMPTION

$$\frac{52 \times 3}{6356 \times .5}\ (HP) \times 2545\ \frac{BTU}{HP\ HR} \times (8760 - 3035)\ HRS/yR \times \frac{MBTU}{10^6\ BTU} = 0.715\ \frac{MBTU\ el}{yR}$$

### TOTAL CONSUMPTION

TOTAL = COVERED + UNCOVERED

$$= 0.715 + 51.76 = 52.47\ \frac{MBTU\ elec}{yR}$$

RS&H

SUBJECT LETTERKENNY EEAP
AEP NO
SHEET 3 OF 4
DESIGNER G. F.
DATE 3/21/91
CHECKER
DATE

## SAVINGS

### FUEL OIL

SAVINGS = (CURRENT) − (@ COVER)

= 1079 MBTU/YR − 488 MBTU/YR

= 591 MBTU/YR #2 FUEL OIL

### ELECTRICITY

SAVINGS = (CURRENT) − (@ COVER)

= 109 − 52.47

= 56.53 MBTU ELEC/YR

### TOTAL DEPOT

ASSUMPTIONS:

1) ALL TANK FANS OPERATE CONTINUOUSLY AT DESIGN FLOW (PER OSHA REQUIREMENTS)
2) TANKS ARE "USED" 2 SHIFTS/DAY, 5 D/W, 52 W/YR

APPROACH: 1) CALCULATE UNIT HEAT SAVING FACTOR FROM SINGLE TANK PROCEDURE ABOVE
2) APPLY FACTORS TO ALL OTHER TANKS
3) SUM RESULTS FOR TOTAL FACILITY.

UNIT HEAT SAVING FACTOR = HEAT SAVED / CFM

UHSF = 591 MBTU/YR / 5200 CFM = 0.1137 MBTU/CFM YR

RS&H

SUBJECT LETTERKENNY EEAP

AEP NO

SHEET 4 OF 4

DESIGNER G. F.

DATE 3-21-91

CHECKER

DATE

UNIT ELECTRICITY SAVING FACTOR = $\frac{\text{ELECTRIC ENERGY SAVED}}{\text{CFM}}$

$$UESF = \frac{56.55 \frac{\text{MBTU ELEC}}{\text{YR}}}{5200 \text{ CFM}} = 0.0109 \frac{\text{MBTU ELEC}}{\text{CFM YR.}}$$

APPLYING THESE FACTORS TO EACH VENTED TANK (SEE ENCLOSED SPREADSHEET CALCULATION) YIELDS:

TOTAL FACILITY HEAT SAVED = $\Sigma$ INDIVIDUAL TANKS.

= 26,034 MBTU FUEL/YR

TOTAL FACILITY ELEC ENERGY SAVED = $\Sigma$ INDIVIDUAL TANKS

= 2,496 $\frac{\text{MBTU ELEC}}{\text{YR.}}$

LETTERKENNY ARMY DEPOT
DIP TANK COVER
SUMMARY

| | Building Number | Tank ID | Design Ventil. (cfm) | Common or Dedicated Fan (D)-(C) | Annual FUEL(5& 6)Saved (Mbtu) | Value of Saved Energy ($/yr) | Annual Electric Saved (Mbtu) | Value of Saved Ele Energy ($/yr) | Total Cost Savings ($/yr) | Const. Cost* ($) | Payback (Yrs) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1N | 2861-1 | 10,000 | D | 1,137 | $5,014 | 109 | $1,192 | $6,207 | $9,148 | 1.5 |
| | | 2861-2 | 3,750 | C | 426 | $1,880 | 41 | $447 | $2,327 | $1,438 | 0.6 |
| | | 2861-3 | 7,500 | C | 853 | $3,761 | 82 | $894 | $4,655 | $1,438 | 0.3 |
| | | 2861-4 | 7,500 | C | 853 | $3,761 | 82 | $894 | $4,655 | $1,438 | 0.3 |
| | | 2861-5 | 7,500 | C | 853 | $3,761 | 82 | $894 | $4,655 | $1,438 | 0.3 |
| | | 2861-6 | 7,500 | D | 853 | $3,761 | 82 | $894 | $4,655 | $9,148 | 2.0 |
| | | 2861-7 | 7,500 | C | 853 | $3,761 | 82 | $894 | $4,655 | $1,438 | 0.3 |
| | | 2861-8 | 7,500 | C | 853 | $3,761 | 82 | $894 | $4,655 | $1,438 | 0.3 |
| | | 400 | 3,060 | C | 348 | $1,534 | 33 | $365 | $1,899 | $1,438 | 0.8 |
| | | 402 | 4,500 | D | 512 | $2,256 | 49 | $537 | $2,793 | $9,148 | 3.3 |
| | | 378 | 4,500 | C | 512 | $2,256 | 49 | $537 | $2,793 | $1,438 | 0.5 |
| | | 377 | 4,500 | C | 512 | $2,256 | 49 | $537 | $2,793 | $1,438 | 0.5 |
| | | 4577 | 1,560 | C | 177 | $782 | 17 | $186 | $968 | $1,438 | 1.5 |
| | | 4741 | 4,050 | C | 460 | $2,031 | 44 | $483 | $2,514 | $1,438 | 0.6 |
| Subtotal | 1N | 14 | 80,920 | 3 | 9,201 | $40,575 | 882 | $9,649 | $50,224 | $43,262 | 0.9 |
| | 37 | 2568 | 6,800 | D | 773 | $3,410 | 74 | $811 | $4,221 | $9,148 | 2.2 |
| | | 4318 | 5,200 | D | 591 | $2,607 | 57 | $620 | $3,227 | $9,148 | 2.8 |
| | | 4319 | 9,600 | D | 1,092 | $4,814 | 105 | $1,145 | $5,958 | $9,148 | 1.5 |
| | | 4193 | 6,000 | D | 682 | $3,009 | 65 | $715 | $3,724 | $9,148 | 2.5 |
| Subtotal | 37 | 4 | 27,600 | 4 | 3,138 | $13,839 | 301 | $3,291 | $17,130 | $36,592 | 2.1 |
| | 350N | 2514 | 9,360 | D | 1,064 | $4,693 | 102 | $1,116 | $5,809 | $9,148 | 1.6 |
| | | 2516 | 6,480 | D | 737 | $3,249 | 71 | $773 | $4,022 | $9,148 | 2.3 |
| | | 2518 | 9,360 | D | 1,064 | $4,693 | 102 | $1,116 | $5,809 | $9,148 | 1.6 |
| | | 2520 | 12,600 | D | 1,433 | $6,318 | 137 | $1,502 | $7,820 | $9,148 | 1.2 |
| | | 2744 | 5,500 | D | 625 | $2,758 | 60 | $656 | $3,414 | $9,148 | 2.7 |
| | | 1479 | 3,600 | D | 409 | $1,805 | 39 | $429 | $2,234 | $9,148 | 4.1 |
| | | 1480 | 6,860 | D | 780 | $3,440 | 75 | $818 | $4,258 | $9,148 | 2.1 |
| | | 2606 | 993 | D | 113 | $498 | 11 | $118 | $616 | $9,148 | 14.8 |
| | 350S | 2531 | 12,000 | D | 1,364 | $6,017 | 131 | $1,431 | $7,448 | $9,148 | 1.2 |
| | | 2536 | 11,000 | D | 1,251 | $5,516 | 120 | $1,312 | $6,827 | $9,148 | 1.3 |
| | | 2539 | 2,500 | D | 284 | $1,254 | 27 | $298 | $1,552 | $9,148 | 5.9 |
| Subtotal | 350 | 11 | 80,253 | 11 | 9,125 | $40,240 | 875 | $9,570 | $49,810 | $100,628 | 2.0 |

LETTERKENNY ARMY DEPOT
DIP TANK COVER
SUMMARY

| Building Number | Tank ID | Design Ventil. (cfm) | Common or Dedicated Fan (D)-(C) | Annual FUEL(5& 6)Saved (Mbtu) | Value of Saved Energy ($/yr) | Annual Electric Saved (Mbtu) | Value of Saved Ele Energy ($/yr) | Total Cost Savings ($/yr) | Const. Cost* ($) | Payback (Yrs) |
|---|---|---|---|---|---|---|---|---|---|---|
| 370 | T-1 | 3,800 | C | 432 | $1,905 | 41 | $453 | $2,359 | $1,438 | 0.6 |
| | T-2 | 2,700 | C | 307 | $1,354 | 29 | $322 | $1,676 | $1,438 | 0.9 |
| | T-3 | 5,700 | D | 648 | $2,858 | 62 | $680 | $3,538 | $9,148 | 2.6 |
| | T-4 | 5,700 | C | 648 | $2,858 | 62 | $680 | $3,538 | $1,438 | 0.4 |
| | T-5 | 3,600 | C | 409 | $1,805 | 39 | $429 | $2,234 | $1,438 | 0.6 |
| | T-6 | 2,700 | C | 307 | $1,354 | 29 | $322 | $1,676 | $1,438 | 0.9 |
| | T-7 | 5,700 | D | 648 | $2,858 | 62 | $680 | $3,538 | $9,148 | 2.6 |
| | T-8 | 3,800 | C | 432 | $1,905 | 41 | $453 | $2,359 | $1,438 | 0.6 |
| | T-9 | 2,700 | C | 307 | $1,354 | 29 | $322 | $1,676 | $1,438 | 0.9 |
| | T-10 | 3,800 | C | 432 | $1,905 | 41 | $453 | $2,359 | $1,438 | 0.6 |
| Subtotal | 370 | 10 | 40,200 | 2 | 4,571 | $20,157 | 438 | $4,794 | $24,951 | $29,800 | 1.2 |
| Total | 4 | 39 | 228,973 | 20 | 26,034 | $114,811 | 2,496 | $27,304 | $142,115 | $210,282 | 1.5 |

* Costs for differential pressure controls and VF drives are not distributed over tanks sharing a common fan.

QRIP Calc using FY 92 Fuel Oil Prices

Current energy use:

$$Elec = Fan\ Hp * Btu/Hp * 3760\ hr/yr * \frac{1\ MBtu}{10^6\ MBtu} * 10.94\$/MBtu$$

$$Fan\ Hr = \frac{cfm\ \Delta P}{6356\ \eta_{fan}}$$

$$= \frac{(228,973)(2)}{(6356)(0.5)} * 2545\frac{Btu}{Hp\,Hr} * \frac{8760}{10^6} * 10.94\$/MBtu = \$52,700/yr.$$

$$Fuel\ Oil = cfm * HLF \div \eta_{blr} = 228,973 * 0.166 \div 0.8 = 47,512\ MBtu/yr$$

$$47,512 * 4.41\$/MBtu = \$209,500/yr$$

TOTAL COSTS = $262,200/yr

05/09/91

# ECO Construction Cost Estimate Calculations

ECO Name: Dip Tank Cover

ECO #: 3

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $4,400 |
| Labor | $960 |
| Subtotal bare costs | $5,360 |
| FICA Insurance (20% of Labor) | $192 |
| Sales Tax (6.5% of Material) | $286 |
| Subtotal | $5,838 |
| Overhead (15%) | $876 |
| Subtotal | $6,714 |
| Profit (10%) | $671 |
| Subtotal | $7,385 |
| Bond (1%) | $74 |
| Subtotal | $7,459 |
| Contingency (10%) | $746 |
| Subtotal (Construction Cost Input For LCCID *) | $8,205 |
| SIOH (5.5% of Construction Cost) | $451 |
| Subtotal | $8,656 |
| Design (6% of Construction Cost) | $492 |
| Total Project Cost | $9,148 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

05/09/91

# ECO Construction Cost Estimate Calculations

ECO Name: Dip Tank Covers w/o Controls

ECO #: 3

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $500 |
| Labor | $320 |
| Subtotal bare costs | $820 |
| FICA Insurance (20% of Labor) | $64 |
| Sales Tax (6.5% of Material) | $33 |
| Subtotal | $917 |
| Overhead (15%) | $138 |
| Subtotal | $1,055 |
| Profit (10%) | $106 |
| Subtotal | $1,161 |
| Bond (1%) | $12 |
| Subtotal | $1,173 |
| Contingency (10%) | $117 |
| Subtotal (Construction Cost Input For LCCID *) | $1,290 |
| SIOH (5.5% of Construction Cost) | $71 |
| Subtotal | $1,361 |
| Design (6% of Construction Cost) | $77 |
| Total Project Cost | $1,438 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

09/26/91

ECO Construction Cost Estimate
Calculations

ECO Name: Dip Tank Covers

ECO #: 3

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $97,500 |
| Labor | $25,280 |
| Subtotal bare costs | $122,780 |
| FICA Insurance (20% of Labor) | $5,056 |
| Sales Tax (6.5% of Material) | $6,338 |
| Subtotal | $134,174 |
| Overhead (15%) | $20,126 |
| Subtotal | $154,300 |
| Profit (10%) | $15,430 |
| Subtotal | $169,730 |
| Bond (1%) | $1,697 |
| Subtotal | $171,427 |
| Contingency (10%) | $17,143 |
| Subtotal (Construction Cost Input For LCCID *) | $188,570 |
| SIOH (5.5% of Construction Cost) | $10,371 |
| Subtotal | $198,941 |
| Design (6% of Construction Cost) | $11,314 |
| Total Project Cost | $210,255 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

For QRIP

(p. 3-9)

Covers represent 26% of project cost => $\frac{31980}{122,780} = 0.26$

Therefore $210,257 * 0.26 = \$54,765$

RS&H®

SUBJECT ECO #3 AEP NO 290-0379-001

SHEET ____ OF ____

DESIGNER P. Hutchins DATE ____

CHECKER ____ DATE ____

Additional maintenance costs

Covers will last about 5 years

Therefore, covers will be replaced 3 times over the 15 year project life

For LCCID 1/5 of 39 covers will be replaced annually

1/5 * #600 * 39 = #4700

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION: LEAD

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☐ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify) _____

DRAWING NO.

ESTIMATOR: G. FALLON

CHECKED BY: P. Hutchins

| TANK COVER & FAN CONTROLLER SUMMARY | QUANTITY NO. UNITS | QUANTITY UNIT MEAS. | LABOR PER UNIT | LABOR TOTAL | MATERIAL PER UNIT | MATERIAL TOTAL | TOTAL COST |
|---|---|---|---|---|---|---|---|
| DIP TANK COVER | 39 | EA | 320 | 12,480 | 500 | 19,500 | 31,980 |
| ⓦ MOVEABLE MOUNT. | | | | | | | |
| | | | | | | | |
| FAN PRESSURE | | | | | | | |
| XMITTER | 20 | EA | 160 | 3,200 | 550 | 11,000 | 14,200 |
| CONTROLLER | 20 | EA | 160 | 3,200 | 550 | 11,000 | 14,200 |
| | | | | | | | |
| FAN MOTOR VARI. | | | | | | | |
| FREQ. DRIVE | 20 | EA | 320 | 6,400 | 2800 | 56,000 | 62,400 |
| | | | | | | | |
| | | | | 25,280 | | 97,500 | 122,780 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| For QRIP Covers represent | | | | 131980 | - | 26% of | project costs |
| | | | | 122,780 | | | |

ENG FORM 150
1 AUG 59

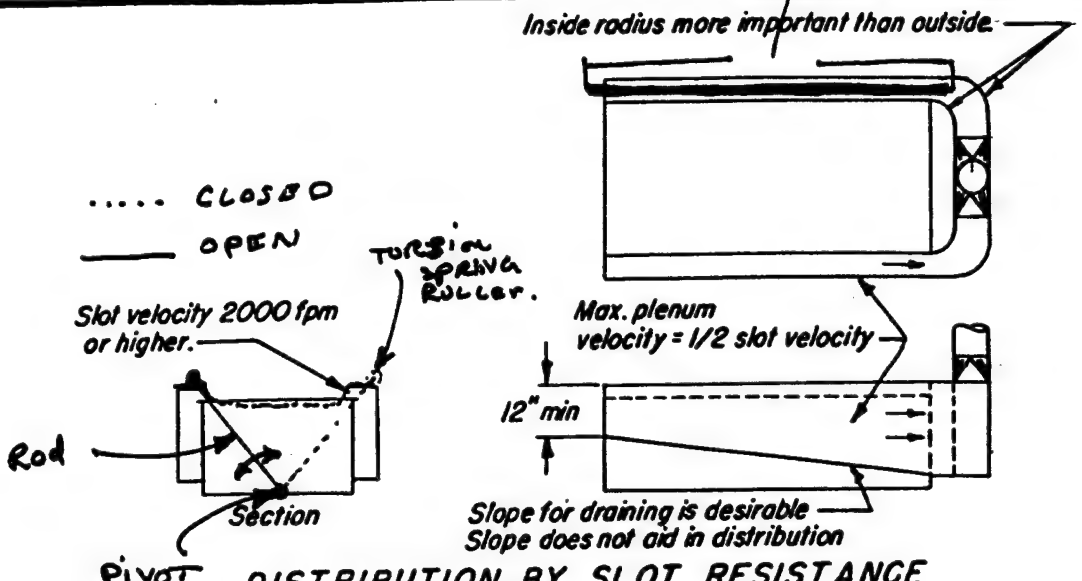
(ER 1110-345-730)

PREVIOUS EDITION MAY BE USED

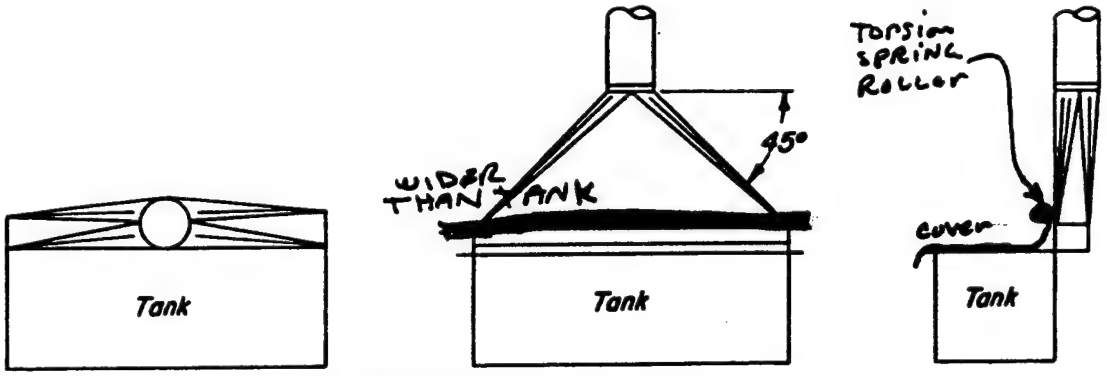
* U.S. GOVERNMENT PRINTING OFFICE : 1958 O—510148

(TRANSLUCENT)

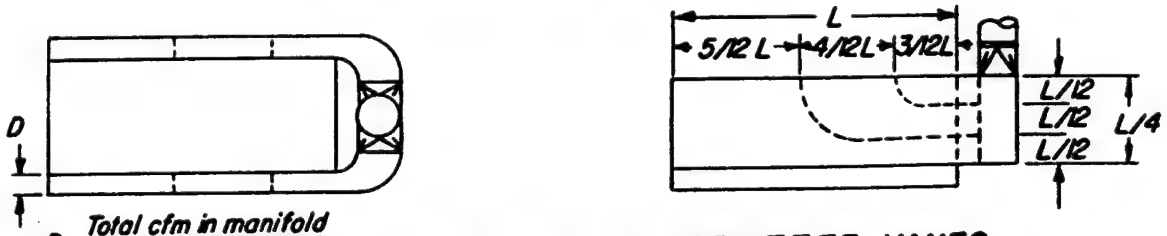
WIDER THAN TANK TO ALLOW OVERHANG




DISTRIBUTION BY SLOT RESISTANCE




DISTRIBUTION BY FISH TAIL




$D = \frac{\text{Total cfm in manifold}}{500 \times L}$

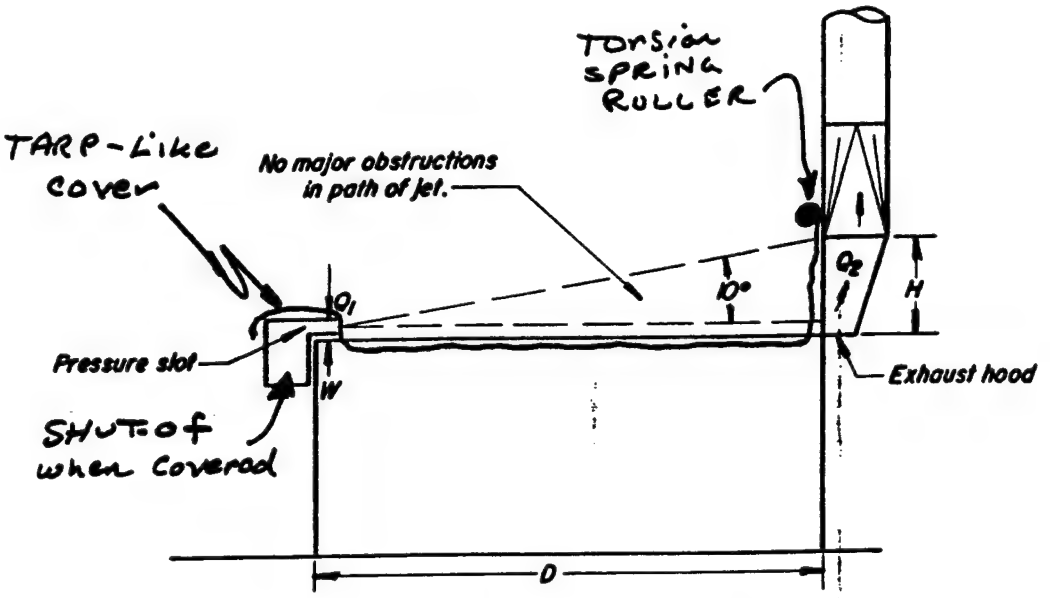
DISTRIBUTION BY SPLITTER VANES

*With low plenum velocities and high slot velocities, good distribution is obtained. If this design is not possible, splitter vanes should be used. Slots over 10 feet to 12 feet in length usually need multiple take-offs.*

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

PRINCIPLES OF MANIFOLD DESIGI

DATE 1-70 | Fig. 4-12




## PUSH PULL HOODS

### Exhaust Hood

Quantity of air exhausted,
$Q_2$ = 100 to 150 cfm /sq. ft. of tank area, depending on temperature of liquid, cross drafts, agitation, etc.

Hood height should be,
$H = D \times \tan 10° = 0.18D$

### Pressure Slot

Quantity of air supplied,

$$Q_1 = \frac{1}{D \times E} \times Q_2$$

where; D = length of throw, feet
E = entrainment factor.

| Throw length, D, feet | Entrainment factor, E |
|---|---|
| 0 - 8 | 2.0 |
| 8 - 16 | 1.4 |
| 16 - 24 | 1.0 |
| over 24 | 0.7 |

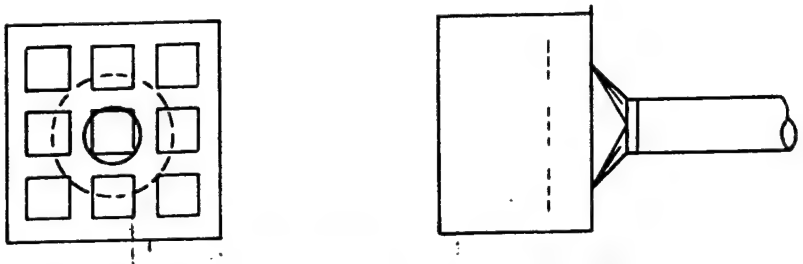
Slot width W should be designed for a velocity of 1000 to 2000 fpm.

Design such systems so they can be easily modified or adjusted to obtain desired results.

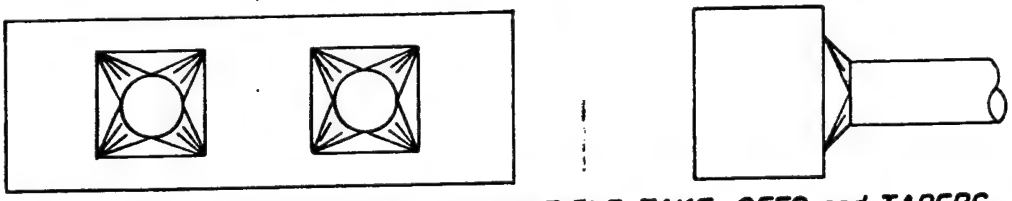
AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

HOOD DESIGN DATA

DATE 1-64 | Fig. 4-17

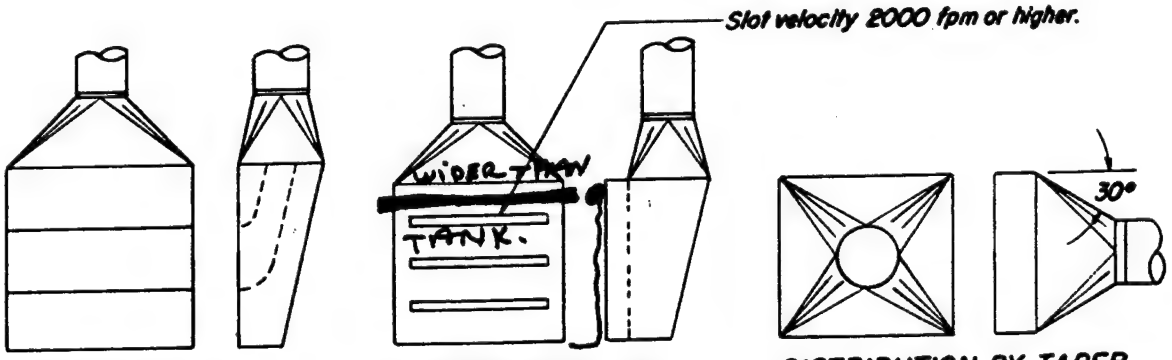


DISTRIBUTION BY BAFFLES
See Fig. 4-16



LONG BOOTHS - DISTRIBUTION BY MULTIPLE TAKE-OFFS and TAPERS

BOOTH-TYPE HOODS
(Same principle apply to canopy type)




DISTRIBUTION BY SPLITTER VANES

DISTRIBUTION BY SLOT (or baffles)

DISTRIBUTION BY TAPER

SIDE-DRAFT & SUSPENDED HOODS

| AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS | |
|---|---|
| PRINCIPLES OF MANIFOLD DESIGN | |
| DATE 1-64 | Fig. 4-13 |

THE KING OF TARPAULINS
GOSPORT MANUFACTURING COMPANY, INC.

DUNS: 04-598-0644
TELEPHONE: 812/879-4224
OUT OF STATE: 800/457-4406
FAX: 812/879-4227
11 LOUSISA STREET, P.O. BOX #26, GOSPORT, INDIANA 47433

March 15, 1991

REYNOLDS, SMITH & HILLS
4651 SALISBURY ROAD
JACKSONVILLE, FL 32256
ATTN: GEORGE FALLEN

Dear George:

Please find the information that I have enclosed for you per our recent phone conversation.

You can be assured that Gosport Manufacturing Company will provide you with the best in quality and excellent service in meeting your tarpaulin needs. Not only do we offer quality, 100% American made products, we stand behind everything we make.

If I can be of any service, or if you have any questions, please do not hesitate to call me at **800-457-4406.** Thank you for your consideration!

Looking forward to doing business with you!

Sincerely,

David S. Daubenheyer

David S. Daubenheyer
Account Executive

DSD/mg

Enclosures

## TARPAULINS

| NAME | CATALOG PAGE | ORDER NUMBER | WEIGHT | DESCRIPTION | COLOR | PRICE (per sq. ft.) |
|---|---|---|---|---|---|---|
| **CANVAS TARPS*** | | | | | | |
| Noble | 4 | TCN08 | 8 oz. | 1½" hem | Drab, Brown | 24¢ |
| Noble | 4 | TCN10 | 10 oz. | 1½" hem | Drab, Brown | 25¢ |
| Noble | 4 | TCN12 | 12 oz. | 1½" hem | Drab, Brown | 27¢ |
| Noble | 4 | TCN15 | 14.9 oz. | 1½" hem | Drab, Brown | 32¢ |
| Royal | 3 | TCR08 | 8 oz. | Reinforced patches, brass grommets | Drab, Brown | 25¢ |
| Royal | 3 | TCR10 | 10 oz. | Reinforced patches, brass grommets | Drab, Brown | 26¢ |
| Royal | 3 | TCR12 | 12 oz. | Reinforced patches, brass grommets | Drab, Brown | 28¢ |
| Royal | 3 | TCR15 | 14.9 oz. | Reinforced patches, brass grommets | Drab, Brown | 33¢ |
| Majestic | 4 | TCM08 | 8 oz. | Rope-in-hem, two rows of stitching | Drab, Brown | 25¢ |
| Majestic | 4 | TCM10 | 10 oz. | Rope-in-hem, two rows of stitching | Drab, Brown | 26¢ |
| Majestic | 4 | TCM12 | 12 oz. | Rope-in-hem, two rows of stitching | Drab, Brown | 28¢ |
| Majestic | 4 | TCM15 | 14.9 oz. | Rope-in-hem, two rows of stitching | Drab, Brown | 33¢ |
| Regal | 3 | TCG08 | 8 oz. | D-rings, reinforced patches, rope-in-hem | Drab, Brown | 26¢ |
| Regal | 3 | TCG10 | 10 oz. | D-rings, reinforced patches, rope-in-hem | Drab, Brown | 27¢ |
| Regal | 3 | TCG12 | 12 oz. | D-rings, reinforced patches, rope-in-hem | Drab, Brown | 29¢ |
| Regal | 3 | TCG15 | 14.9 oz. | D-rings, reinforced patches, rope-in-hem | Drab, Brown | 34¢ |
| **VINYL TARPS** | | | | | | |
| Neoprene | 5 | TVN16 | 16 oz. | Extra durable material | Black | 57¢ |
| Ultimate | 5 | TVL16 | 16 oz. | Flame resistant treated | Grn, Red, Blu | 44¢ |
| Laminated | 5 | TVL14 | 14 oz. | Flame resistant treated | Grn, Red, Blu | 40¢ |
| Coated | 5 | TVC18 | 18 oz. | Tear and puncture resistant | Large variety | 47¢ |
| Coated | 5 | TVC22 | 22 oz. | Tear and puncture resistant | Large variety | 52¢ |
| **POLYETHYLENE TARPS** | | | | | | |
| Ultrastrong | 8 | TPU | | D-rings, reinforced patches, rope-in-hem | Blue | 19¢ |
| All-American | 8 | TPA | | Rope-in-hem, two rows of stitching (Orders less than $100, 0.54 per sq. ft.) | Blue | 0.54 |
| Poly Tarp | 10 | TP08FR | | 8 x 9, flame resistant | Opaque | 14¢ |
| Poly Tarp | 10 | TP10D4 | | 10 x D4 | White/White | 9¢ |
| Poly Tarp | 10 | TP1212 | | 12 x 12 | Black/White | 19¢ |
| Poly Tarp | 10 | TP09UV | | 8 x 9, UV resistant | White/White | 13¢ |
| Poly Tarp | 10 | TPS1010 | | 10 x 10 | Silver | 13¢ |
| Poly-Star Tarps in Poly-Star Section | | | | | | |
| **INFLATION FIGHTER TARPS** | | | | | | |
| | 9 | TIF10 | 10 oz. | Made from piece goods, fabric varies | Varies | 22¢ |
| | 9 | TIF12 | 12 oz. | Made from piece goods, fabric varies | Varies | 23.5¢ |
| **DRY FINISH TARPS** | | | | | | |
| | 9 | TDF10 | 10 oz. | No rub off or discoloration damage | Pearl B | 26¢ |
| | 9 | TDF10S | 10.3 oz. | Army Duck, no rub off damage | Pearl B | 37¢ |

## COVERS

| NAME | CATALOG PAGE | ORDER NUMBER | WEIGHT | DESCRIPTION | COLOR | PRICE (per sq. ft.) |
|---|---|---|---|---|---|---|
| **SWIMMING POOL COVERS** | | | | | | |
| Royal | 9 | CVPR10 | 10 oz. | Vinyl laminated, reinforced patches & webbing | Grn, Red, Blu | 37¢ |
| Royal | 9 | CVPR14 | 14 oz. | Vinyl laminated, reinforced patches & webbing | Grn, Red, Blu | 44¢ |
| American | 9 | CPPAL | | Light weight poly, reinforced patches & webbing | Blue | 13¢ |
| American | 9 | CPPAH | | Heavy weight poly, reinforced patches & webbing | Blue | 23¢ |
| Net | 9 | CNP | | Reinforced patches & webbing | Multi-color | 26¢ |

*Commercial Canvas Flame Resistant, add $4 per square foot.

## COVERS

| NAME | CATALOG PAGE | ORDER NUMBER | WEIGHT | DESCRIPTION | COLOR | PRICE (per sq. ft.) |
|---|---|---|---|---|---|---|
| **CAR COVERS** | | | | | | |
| A | 11 | CDC-A | | Poly-cotton blend, elastic & tie downs | Pearl Green | $54.99 set |
| B | 11 | CDC-B | | Poly-cotton blend, elastic & tie downs | Pearl Green | $61.99 set |
| C | 11 | CDC-C | | Poly-cotton blend, elastic & tie downs | Pearl Green | $67.99 set |
| D | 11 | CDC-D | | Poly-cotton blend, elastic & tie downs | Pearl Green | $72.99 set |
| E | 11 | CDC-E | | Poly-cotton blend, elastic & tie downs | Pearl Green | $77.99 set |
| F | 11 | CDC-F | | Poly-cotton blend, elastic & tie downs | Pearl Green | $84.99 set |
| Bag | 11 | MCSB | | Car cover storage bag | | $3.99 set |
| **TRUCK COVERS** | | | | | | |
| Net | 6 | CNTT | | Top grade PVC coated poly net, 2" hems | Grn, Blu, Blk Multi-color | 34¢ |
| Net | 6 | CNTE | | Economy grade, 1¼" hem | Varies | 29¢ |
| Steel Hauler | 6 | CCH12 | 12 oz. | Cotton Duck, D-rings set into cove bands | Drab, Brown | 39¢ |
| Steel Hauler | 6 | CCH15 | 14.9 oz. | Cotton Duck, D-rings set into cove bands | Drab, Brown | 44¢ |
| Steel Hauler | 6 | CVH18 | 18 oz. | Vinyl coated nylon, D-rings set into cove bands | Large variety | 52¢ |
| **GYM COVERS** | | | | | | |
| Canvas | 13 | CCG10 | 10 oz. | Flame resistant, meets state school fire codes | Tan | Quote |
| Vinyl | 13 | CVG10 | 10 oz. | Completely waterproof & flame resistant Meets state school fire codes | Large variety | Quote |
| **FIELD COVERS** | | | | | | |
| Polyethylene | 13 | CPF | | Completely waterproof, high UV treated | Blue | Quote |
| Vinyl | 13 | CVF10 | 10 oz. | Durable cover, completely waterproof | Large variety | Quote |
| Vinyl | 13 | CVF14 | 14 oz. | Durable cover, completely waterproof | Large variety | Quote |
| **SALVAGE COVERS** | | | | | | |
| Canvas | 10 | CCS12 | 12 oz. | Triple-thick hem | | 39¢ |
| Canvas Duck | 10 | CCSD | #12 | Triple-thick hem | | 44¢ |
| Dry Finish | 10 | CDS10 | 10.36 oz. | Triple-thick hem, no rub off damage | Pearl B | 45¢ |
| Dry Finish | 10 | CDS13 | 13 oz. | Triple-thick hem, no rub off damage | Pearl B | 49¢ |
| Vinyl | 10 | CVS10 | 10 oz. | Vinyl laminated nylon, triple-thick hem | Red, Green .. | 49¢ |
| Vinyl | 10 | CVS14 | 14 oz. | Vinyl laminated nylon, triple-thick hem | Red, Green | 45¢ |

## BOAT COVERS

| NAME | CATALOG PAGE | ORDER NUMBER | WEIGHT | DESIGNED FOR | BOAT LENGTH (Feet) | BEAM WIDTH (Inches) | STOCK NUMBER | OUTBOARD STOCK NUMBER | NET PRICE |
|---|---|---|---|---|---|---|---|---|---|
| Standard | 12 | CDBS14 | 8 oz. | V-Hull | 14 | 68 | RF-14 | | $66.95 |
| Standard | 12 | CDBS15 | 8 oz. | V-Hull | 15 | 76 | RF-15 | | $69.95 |
| Standard | 12 | CDBS16 | 8 oz. | V-Hull | 16 | 76 | RF-16 | | $69.95 |
| Standard | 12 | CDBS17 | 8 oz. | V-Hull | 17 | 80 | RF-17 | | $69.95 |
| Standard | 12 | CDBS18 | 8 oz. | V-Hull | 18 | 86 | RF-18 | | $73.95 |
| Deluxe | 12 | CDBD14 | 10.5 oz. | V-Hull | 14 | 68 | DRF-14 | | $83.95 |
| Deluxe | 12 | CDBD15 | 10.5 oz. | V-Hull | 15 | 76 | DRF-15 | | $87.95 |
| Deluxe | 12 | CDBD16 | 10.5 oz. | V-Hull | 16 | 76 | DRF-16 | | $93.95 |
| Deluxe | 12 | CDBD17 | 10.5 oz. | V-Hull | 17 | 80 | DRF-17 | | $93.95 |
| Deluxe | 12 | CDBD18 | 10.5 oz. | V-Hull | 18 | 86 | DRF-18 | | $97.95 |
| Tri-Hull | 12 | CDBT15 | 10.5 oz. | Cathedral Hulls | 15 | 75 | RI/O-15 | RO-15 | $91.95 |
| Tri-Hull | 12 | CDBT16 | 10.5 oz. | Cathedral Hulls | 16 | 80 | RI/O-16 | RO-16 | $93.95 |
| Tri-Hull | 12 | CDBT17 | 10.5 oz. | Cathedral Hulls | 17 | 82 | RI/O-17 | RO-17 | $95.95 |
| Tri-Hull | 12 | CDBT18 | 10.5 oz. | Cathedral Hulls | 18 | 86 | RI/O-18 | RO-18 | $97.95 |

# Telephone Call Confirmation

Project No. _____

reynolds, smith and hills

Local _____ L.D. X Placed _____ Rec'd X Date 3-21-91

G. FALLON G.M.F. Conversed with BOB FINK (717) 782-3902

Of OSHA HARRISBURG, PA. Regarding DIP TANK COVERS.

---

G.F. EXPLAINED FLEXIBLE DIP TANK COVERS WITH FAN ΔP CONTROLS.

B.F. ADVISED THAT OSHA HAS VERY SPECIFIC REQULATIONS RE: MINIMUM DIP TANK AIR FLOW REQVIREMENTS AIMED AT PROTECTING WORKERS FROM ON THE JOB HAZARDS.

ALTHOUGH REDUCING THE AIR FLOW WOULD BE A "TECHNICAL" VIOLATION, NO CITATION WOULD BE ISSUED AS LONG AS THERE WAS NO HAZARD TO THE WORKER.

HE FELT THAT AS LONG AS THE FANS were drawing AIR FROM THE CAVITY BETWEEN THE COVER AND THE FLUID THAT ANY EVOLVED FUMES WOULD STILL BE EXHAUSTED.

NOTE: MR FINK ADVISED THAT DIP TANK VENT FANS SHOULD BE OPERATED AT ALL TIMES (24 HRS/day) AS A GENERAL RULE. THIS WAS ECHOED BY LEAD HYGIENISTS.

---

Distribution:

**DOCUMENTATION FOR PRODUCTIVITY CAPITAL INVESTMENT PROGRAMS**
For use of this form, see AR 5-4; the proponent agency is OCA.

1. PROJECT NO.: AMC OSD PIF

REQUIREMENT CONTROL SYMBOL DD-M(R) 1561

2. TO:
HQ DA
Attn: DACS-DME
Pentagon
Washington, DC 20310-2070

3. THRU:
US AMC
Attn: AMCMM-M
5001 Eisenhower Ave
Alexandria, VA 22303-0001

4. FROM:
Commander
US DESCOM
Attn: AMSDS-RM-P
Chambersburg, PA 17201-4170

5. DOD COMP NAME: Army

6. DOD COMP CODE: A

7. COMMAND CODE: W73QKK

8. DATE: 10/9/91

9. PROJECT TITLE
Drive-In Paint Booth Air Flow Control

10. TYPE OF PROJECT (Check one)
☐ QRIP ☒ OSD PIF ☐ PECIP

11. AMORTIZATION YEARS/MONTHS
$ 237,128 (Project Cost) ÷ 64,100 (Average Annual Savings) X 12 (No. Mos)
= 3.7 (years) or - (months) (amortization)

12. FUNCTIONAL AREA WHERE SAVINGS WILL OCCUR
024

13. ECONOMIC LIFE
15

14. EXPECTED OPERATIONAL DATE

15. SUBMITTING UNIT(S)
Commander
Letterkenny Army Depot
Attn: SDSLE-EM (T. Hagie)
Bldg. 663
Chambersburg, PA 17201-4150

16. UNIT ID CODE

17. PROJECT DESCRIPTION
Speed controllers are used on exhaust and supply fans to maintain correct ventilation rates under varying conditions and minimize flow during unoccupied times.

18. DETAILED JUSTIFICATION
Supply and exhaust fans operate continuously during work shifts for convenience and to keep back flow due to building negative pressure. This project would allow fans to throttle back and save energy when booths are unoccupied, but not allow back flow of outside air.

19. SAVINGS DISPOSITION
Savings are used to reduce energy expenditures

20. OTHER REMARKS (Continue on page 5, if more space is needed)

DA FORM 5108-R, MAY 82

*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R).*

21a. SUMMARY OF DOLLAR SAVINGS
*(ROUND OFF TO THE NEAREST DOLLAR)*

*Attach computation sheet identifying the method and source of data for savings*

| SAVINGS BREAKOUT | PRESENT METHOD | PROPOSED METHOD | | | | DIFFERENCE/SAVINGS | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1ST YR | 2D YR | 3D YR | 4TH YR | 1ST YR | 2D YR | 3D YR | 4TH YR |
| SALARY/LABOR/ OVERTIME | | | | | | | | | |
| MATERIAL/ SUPPLIES | | | | | | | | | |
| UTILITIES | | | | | | | | | |
| MAINTENANCE/ REPAIR | | | | | | | | | |
| TRANSPORTATION | | | | | | | | | |
| LEASE COSTS | | | | | | | | | |
| SALVAGE/ TURN-IN | | | | | | | | | |
| ENERGY *(Identify)* Elec. & fuel oil | $261,800 | $197,700 | $197,700 | $197,700 | $197,700 | $64,100 | $64,100 | $64,100 | $64,100 |
| CONTRACT COSTS | | | | | | | | | |
| OTHER *(Identify)* _____ | | | | | | | | | |
| TOTALS | $261,800 | $197,700 | $197,400 | $197,700 | $197,700 | $64,100 | $64,100 | $64,100 | $64,100 |

b. PRIORITIZATION

(1) INTERNAL RATE OF RETURN *(IRR)*

Divide estimated project cost 237,128 by average annual savings 64,100 = 3.7 factor.

Based on factor and number of years economic life of the project, select the IRR from Table H-3, App H, Ch. 5, AR 5-4 = 30 % IRR.

(2) SAVINGS TO INVESTMENT RATIO *(S/I)*

Multiply annual savings 64,100 X discount factor 7.98 = 511,500 and divide by present value of investment *(undiscounted)* 237,128 = 2.2 S/I.

(Based on economic life 15 years, select discount factor from Table H-4, App H, Ch. 5, AR 5-4.

(3) RATE OF INVESTMENT PER MANPOWER SPACE *(RIMS)* N/A

Divide estimated project cost _____ by number of manpower space savings _____ = _____ RIMS.

*(Manpower requivalents cannot be used in this computation.)*



*Figure H-1. Documentation for Productivity Capital Investment Program (DA Form 5108-R)*—Continued.

22. COST FOR PROJECT TO BECOME OPERATIONAL

| EQUIPMENT TYPE a | PROPOSED SOURCE OF PROCUREMENT b | UNIT PRICE c | QUANTITY d | TOTAL COST e | APPROPRIATION, BUDGET ACTIVITY OR PROGRAM ELEMENT f | FY FUNDS REQUIRED g |
|---|---|---|---|---|---|---|
| (1) Variable-Speed Controls and Devices | - | $5,928 | 40 | $237,128 | | |
| (2) | | | | | | |
| (3) | | | | | | |
| (4) | | | | | | |
| (5) | | | | | | |
| (6) TRANSPORTATION (Equipment delivery) | | | | | | |
| (7) EQUIPMENT MODIFICATION[1] | | | | | | |
| (8) EQUIPMENT INSTALLATION | | | | | | |
| (9) MAINTENANCE CONTRACT[2] | | | | | | |
| (10) FACILITIES MODIFICATION[3] | | | | | | |
| (11) TRAINING | | | | | | |
| (12) OTHER (Specify): | | | | | | |
| (13) TOTAL REQUIRED FOR PROJECT TO BECOME OPERATIONAL[4] | | | | $237,128 | | |
| (14) TOTAL AMOUNT OF FUNDING REQUESTED IN THIS PROPOSAL | | | | $237,128 | | |
| (15) TOTAL AMOUNT OF FUNDING REQUIRED FROM OTHER SOURCE[5] | | | | - | | |
| (16) TOTAL (Sum of (14) + (15) above) | | | | $237,128 | | |

[1] *Not to exceed 10% of equipment cost for QRIP projects.*

[2] *Applicable to OPA QRIP provided cost is included in packaged deal involving one bill for the equipment and initial maintenance.*

[3] *Normally not OPA funded.*

[4] *Used to compute amortization in Item 11.*

[5] *Specify source to include certification that funds are available, if financed from the regular budget:*

*Page 3 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

23. SUMMARY OF SAVINGS *(MANPOWER AND DOLLARS)*

| ITEMS | SAVINGS | | | REAPPLICATION OF SAVINGS | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | NO. MPR OR MHR | TYPE PERS[6] | DOLLARS | PROGRAM ELEMENT | | TDA PARA AND LINE | | FUNCTION CODE | |
| a | b | c | d | e. FROM | f. TO | g. FROM | h. TO | i. FROM | j. TO |
| (1) REQUIREMENTS AND AUTHORIZATIONS ELIMINATED | | | | | | | | | |
| (2) REQUIREMENTS ONLY ELIMINATED | | | | | | | | | |
| (3) BORROWED MILITARY MANPOWER RELEASED | | | | | | | | | |
| (4) OVERHIRES OR TEMPORARIES TERMINATED | | | | | | | | | |
| (5) HOURS OVERTIME ELIMINATED | | | | | | | | | |
| (6) MANHOURS SAVED FROM MULTIPLE POSITIONS[7] | | | | | | | | | |
| (7) OTHER DOLLAR SAVINGS *(Excluding Manpower)*, e.g., CONTRACT COSTS & UTILITIES | | | | | | | | | |
| (8) Electricity | | | $16,400 | | | | | | |
| (9) #2 Fuel Oil | | | $28,300 | | | | | | |
| (10) #6 Fuel Oil | | | $19,400 | | | | | | |
| (11) TOTAL DOLLAR SAVINGS | | | $64,100 | | | | | | |

[6] *(1) US Graded*
*(2) US Wage Board*
*(3) DHFN*
*(4) IHFN*
*(5) Officer*
*(6) WO*
*(7) Enlisted*

[7] *Reflect specific duties being performed with additional manhours available (equivalent manyears)*

*Page 4 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

24. REGULATORY APPROVAL/COORDINATION

a. INVESTMENT STATEMENT

This proposal has been reviewed and it cannot be implemented with existing equipment or facilities. This investment is in accordance with established investment planning. The project complies with public laws, OSD policies and regulations, and all other regulatory constraints.

*(Cite regulatory approvals, e.g., TAGO Control No.) (Ex. New Start, TAGO Approval, etc.)*

b. OTHER COORDINATION *(Functional Coordination at local level, e.g., Fac Eng, Log, Pers, etc.)*

| | | |
|---|---|---|
| 25. SUBMITTED BY *(Typed name, grade and title of Subordinate Command/Agency or Project Initiator)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| 26. APPROVAL RECOMMENDED BY *(MACOM/Agency)* | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |
| *FOR USE BY HQDA ON OSD PIF PROJECTS ONLY* | | |
| 27. APPROVED BY | SIGNATURE | DATE *(YYMMDD)*<br>AUTOVON |

28. OTHER REMARKS *(Cont'd)*

*Page 5 of DA Form 5108-R*

*Figure H–1. Documentation for Productivity Capital Investment Program (DA Form 5108–R)*—Continued.

ECO Number: 10

DRIVE-IN PAINT BOOTH AIR FLOW CONTROL

Discussion

The two paint booths in Building 350 and the eight in Building 320 are large enough to enclose large tracked and wheeled vehicles. Supply air fans move outside air across a steam coil and into the paint booth. The exhaust fans draw air and fumes from the booth and discharge them to the atmosphere. Because of the variable pressure drops caused by the filters and the unsteady building negative pressure, the fans are hard to balance. This imbalance sometimes causes low air flows, a violation of OSHA regulations, and positive booth pressure which releases paint fumes into the building, a fire hazard. Additionally, the fans are allowed to operate at all times, even though no painting is being done because, while running, they prevent cold air from being drawn back into the booth by the negative pressure in the building. During the winter this back flow would allow cold air to blow on a freshly painted vehicle potentially ruining the paint job, and making the surroundings uncomfortably cold.

The recommended controls would solve all of these problems. Both supply and exhaust air fans are supplied with variable frequency (variable speed) drives and analog control loops. The supply air fans would supply the required flow, and the exhaust fans would maintain the required negative pressure. The supply air fan would supply the required air flow even if the filters get a little plugged, or if the building pressure were to change. Likewise, the exhaust fan would remove just enough air to keep the booth under a slightly negative pressure relative to the building interior. When painting is stopped, and the booth doors opened, the fans (supply and exhaust) would reduce speed to minimize backdraft air flow. Furthermore, in a manual mode, the controls will allow accelerated warm-up of cold vehicles inside the booth. This would liberate the valuable floor space in Building 350, now used for this purpose, for other, more productive activities.

The recommended fan controls optimize booth air flow and pressure while painting is under way and reduces air flow to a minimum when there are no

painting activities. These controls will save energy through reduced electrical consumption and reduced fuel consumption.

Recommendations

Based on the Life Cycle Cost Analysis, this project is recommended.

| | |
|---|---|
| Construction Cost | $212,670 |
| Annual Energy Savings (MBtu/yr) | |
| Electricity | 1,503 |
| No. 6 Fuel Oil | 4,397 |
| No. 2 Fuel Oil | 5,674 |
| Annual Energy Cost Savings ($/yr) | $64,100 |
| SIR | 3.8 |
| Simple Payback (years) | 3.7 |

LIFE CYCLE COST ANALYSIS SUMMARY — STUDY: ECO10
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) — LCCID 1.062
INSTALLATION & LOCATION: LETTERKENNY ADREGION NOS. 3 CENSUS: 1
PROJECT NO. & TITLE: ECO #10 PAINT BOOTH AIR FLOW CONTROL
FISCAL YEAR 1992 DISCRETE PORTION NAME: TOTAL PROJECT
ANALYSIS DATE: 10-14-91 ECONOMIC LIFE 15 YEARS PREPARED BY: G. FALLON

1. INVESTMENT

| | |
|---|---|
| A. CONSTRUCTION COST | $ 212670. |
| B. SIOH | $ 11697. |
| C. DESIGN COST | $ 12761. |
| D. SALVAGE VALUE COST | -$ 0. |
| E. TOTAL INVESTMENT (1A + 1B + 1C - 1D) | $ 237128. |

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

| FUEL | UNIT COST $/MBTU(1) | SAVINGS MBTU/YR(2) | ANNUAL $ SAVINGS(3) | DISCOUNT FACTOR(4) | DISCOUNTED SAVINGS(5) |
|---|---|---|---|---|---|
| A. ELECT | $ 10.94 | 1503. | $ 16443. | 10.75 | 176760. |
| B. DIST | $ 4.98 | 5674. | $ 28257. | 14.08 | 397852. |
| C. RESID | $ 4.41 | 4397. | $ 19391. | 16.21 | 314324. |
| D. NAT G | $ .00 | 0. | $ 0. | 13.25 | 0. |
| E. COAL | $ .00 | 0. | $ 0. | 11.13 | 0. |
| F. TOTAL | | 11574. | $ 64090. | | $ 888937. |

3. NON ENERGY SAVINGS(+) / COST(-)

| | | |
|---|---|---|
| A. ANNUAL RECURRING (+/-) | | $ 0. |
| (1) DISCOUNT FACTOR (TABLE A) | 10.59 | |
| (2) DISCOUNTED SAVING/COST (3A X 3A1) | | $ 0. |
| C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4) | | $ 0. |

D. PROJECT NON ENERGY QUALIFICATION TEST
(1) 25% MAX NON ENERGY CALC (2F5 X .33) $ 293349.
A IF 3D1 IS = OR > 3C GO TO ITEM 4
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)_____
C IF 3D1B IS = > 1 GO TO ITEM 4
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YRS ECONOMIC LIFE)) $ 64090.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) $ 888937.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 3.75
(IF < 1 PROJECT DOES NOT QUALIFY)

7. SIMPLE PAYBACK PERIOD (ESTIMATED) SPB=1F/4 3.70

RS&H

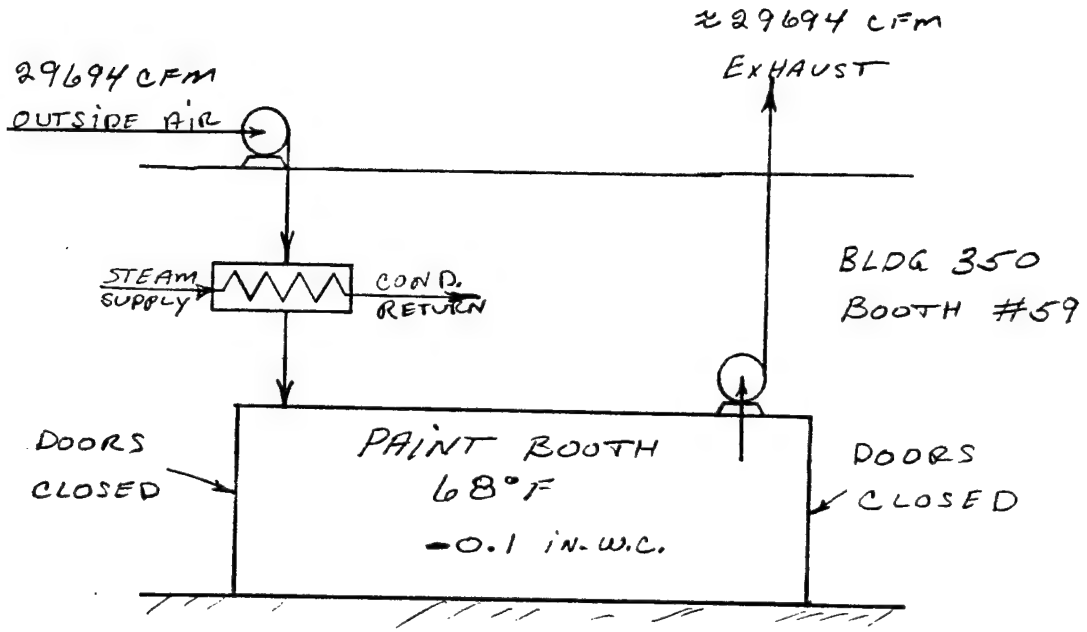
SUBJECT LEAD ECO #10 AEP NO 290-0379-001

SHEET 1 OF

DESIGNER G. Fallon DATE

CHECKER P. Hutchins DATE

# ECO #10 PAINT BOOTH AIR FLOW CONTROL




## CALCULATE CURRENT HEAT LOSS

ASSUME: 68°F EXHAUST TEMP
29,694 CFM (LEAD, PAINT BOOTH STUDY, BKA, 1987, Pg 94)
BOTH FANS CAN BE SHUT DOWN FOR 50% OF THE TIME.
24 H/d, 5d/wk OPERATION
118,470 BTU/CFM/YR (HEAT LOSS CALC., ENCLOSED)
0.8 BOILER EFFICIENCY.

$$\text{CONSUMPTION} = \frac{118470\ \text{BTU/CFM·YR} \times 29694\ \text{CFM}}{0.8 \times 10^6\ \text{BTU/MBTU}} = 4{,}400\ \text{MBTU/YR}$$

## SAVINGS #6 OIL

#6 oil

ENERGY = 4,400 MBTU/YR X 0.5 = 2200 MBTU/YR

RS&H

SUBJECT LEAD ECO #10 AEP NO

SHEET 2 OF

DESIGNER G.F. DATE

CHECKER DATE

ECO 10 (CONT.)

CALCULATE CURRENT ELECTRICAL CONSUMPTION

ASSUME: TOTAL $\Delta P$ = 5.0 IN w.c (2.5" IN & 2.5" OUT)

FAN & MOTOR Eff = 0.6 $\frac{2545}{6356} = 0.4$

$$\text{FAN ENERGY} = \frac{.4 \times \text{FLOW} \times \text{HEAD}}{0.6} = \frac{.4 \times 29694\ \text{CFM} \times 5}{0.6} = 99081\ \text{BTU/hr}$$

$$\text{ANNUAL ENERGY} = \frac{99081\ \text{BTU/hr} \times 24\ \text{H/d} \times 5\ \text{d/wk} \times 52\ \text{w/yr}}{10^6\ \text{BTU/MBTU}} = \boxed{618\ \text{MBTU/yr}}$$

SAVINGS

ENERGY ELEC

618 MBTU/yr × 0.5 = 309 MBTU/yr ELEC

COST ELEC

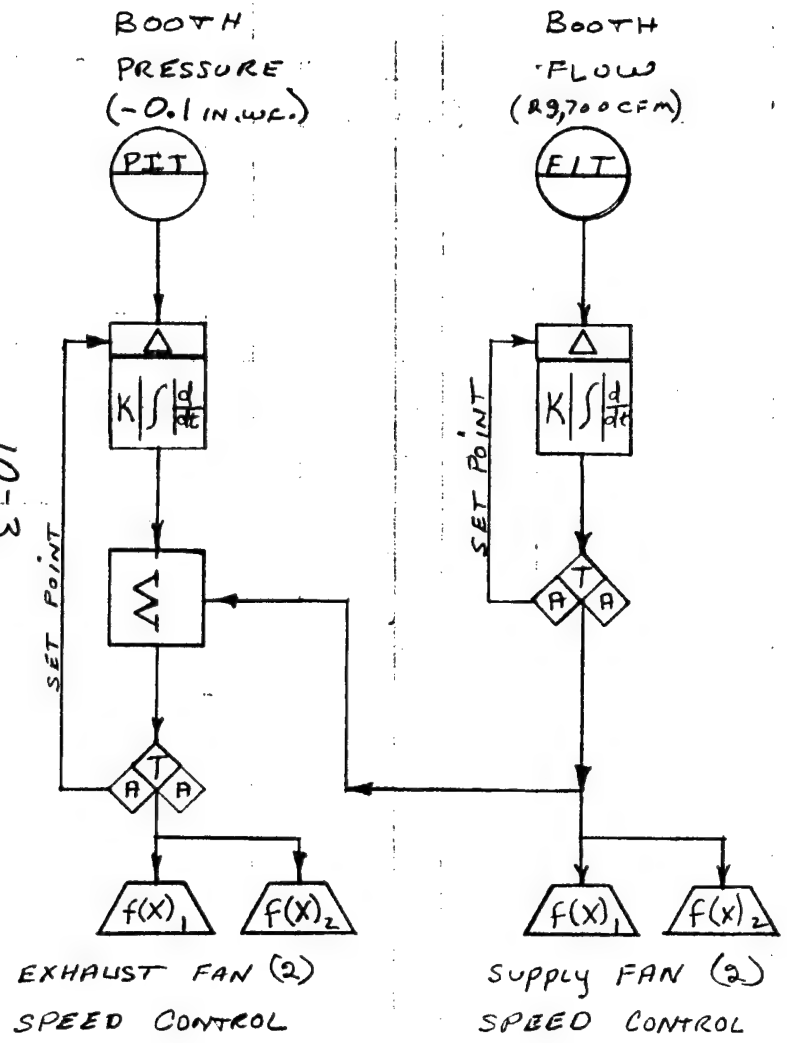
309 MBTU/yr × $10.94/MBTU = $3382/yr ELEC.

TOTAL SAVINGS

FROM pg 1: #6 OIL – 2200 MBTU/yr

ELEC – 309 MBTU/yr

NOTE: THE ABOVE TECHNIQUE WAS APPLIED TO LARGE PAINT SPRAY BOOTHS IN BLDGS 350 & 320 USING SPREAD SHEET SOFTWARE TO GENERATE A PAYBACK ON EACH BOOTH. THE RESULTS ARE SHOWN ON THE SUMMARY SHEET.




10-3

1) WHEN BOTH LARGE DOORS ARE CLOSED BOTH CONTROL LOOPS ARE OPERATING & CONTROLING

2) WHEN EITHER LARGE DOOR IS OPEN, BOTH FAN SPEEDS ARE REDUCED TO A MINIMUM, AUTOMATICALLY

3) THIS CONTROL SCHEME ASSURES DESIGN FLOW THROUGH THE BOOTH AT A SLIGHTLY NEGITIVE PRESSURE.

FLOW & PRESSURE WILL BE MAINTAINED REGARDLESS OF BUILDING NEGATIVE PRESSURE, SEASON OF YEAR, OR REASONABLE DEGREE OF SYSTEM CLEANLINESS.

RSH®

SUBJECT LETTERKENNY A-D.

DESIGNER GF

CHECKER

DATE

AEP NO

SHEET 3 OF

DATE

LETTERKENNY army DEPOT
LARGE PAINT BOOTH FAN CONTROL
SUMMARY

**RECOMMENDED**

| BUILDING NUMBER | BOOTH NUMBER | AIR FLOW (CFM) | OPERATION HOURS PER WEEEK | #6 FUEL SAVED (MBTU) | ELEC SAVED (MBTU) | COST SAVED ($/YR) | CONST. COST ($) | PAYBACK (YRS) |
|---|---|---|---|---|---|---|---|---|
| 350 | 59 | 29694 | 120 | 2199 | 309.1 | $13,078 | $23,713 | 1.8 |
| 350 | 60 | 29694 | 120 | 2199 | 309.1 | $13,078 | $23,713 | 1.8 |
| SUBTOTAL | | 59388 | 120 | 4397 | 618 | $26,156 | $47,426 | 1.8 |

| BUILDING NUMBER | BOOTH NUMBER | AIR FLOW (CFM) | OPERATION HOURS PER WEEEK | #2 FUEL SAVED (MBTU) | ELEC SAVED (MBTU) | COST SAVED ($/YR) | CONST. COST ($) | PAYBACK (YRS) |
|---|---|---|---|---|---|---|---|---|
| 320 | 3880 | 58876 | 40 | 1311 | 204.3 | $8,762 | $23,713 | 2.7 |
| 320 | 4378 | 29172 | 40 | 649 | 101.2 | $4,342 | $23,713 | 5.5 |
| 320 | 4379 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| 320 | 4380 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| 320 | 4381 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| 320 | 4382 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| 320 | 4383 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| 320 | 4384 | 27805 | 40 | 619 | 96.5 | $4,138 | $23,713 | 5.7 |
| SUBTOTAL | | 254878 | 40 | 5674 | 884 | $37,932 | $189,704 | 5.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| GRAND TOTAL | #6 FUEL | 4397 | 1503 | $64,088 | $237,130 | 3.7 |
| | #2 FEUL | 5674 | | | | |

**NOT RECOMMENDED**

| BUILDING NUMBER | BOOTH NUMBER | AIR FLOW (CFM) | OPERATION HOURS PER WEEEK | #2 FUEL SAVED (MBTU) | ELEC SAVED (MBTU) | COST SAVED ($/YR) | CONST. COST ($) | PAYBACK (YRS) |
|---|---|---|---|---|---|---|---|---|
| 320 | 3930 | 2000 | 40 | 36 | 6.9 | $253 | $23,713 | 93.6 |
| 320 | 3931 | 2000 | 40 | 36 | 6.9 | $253 | $23,713 | 93.6 |

RS&H®

SUBJECT ECO # 10 AEP NO

SHEET OF

DESIGNER P. Hutchins DATE

CHECKER DATE

QRIP Calculations Using FY92 Fuel Oil Prices

Current energy use:

#6 Fuel Oil = $\frac{HLF * cfm * 4.41\#/MBtu}{0.8 \cdot 10^6}$

= $\frac{118{,}470 \frac{Btu}{cfm\,yr} * 59{,}388 cfm * 4.41}{0.8 * 10^6} = \$\ 38{,}800$

#2 Fuel Oil = $\frac{118{,}470 * 254.878 \times 4.98}{0.8 * 10^6} = \$\ 188{,}000$

Electricity = $\frac{CFM \cdot \Delta P \cdot 2545 Btu/hp\text{-}hr * hrs/yr.}{6356 * \eta_F}$

= $\frac{254{,}878 * 5 * 2545 * 24 h/d * 5 d/w * 52 w/yr}{6356 * 0.6}$

= 5307 MBtu

Cost = 5307 * 10.94 $/MBtu = $35,000

TOTAL COST = $261,800

LETTERKENNY ARMY DEPOT ENERGY AUDIT OF INDUSTRIAL FACILITIES

Operation Hrs/Day = 24

| | | |
|---|---|---|
| Room or Supply Air Conditions - Winter | | 68 |
| Air Quantity (cfm) | | 1 |
| Hour Fractions | 1 AM - 9 AM | 1 |
| | 9 AM - 5 PM | 1 |
| | 5 PM - 1 AM | 1 |
| Operation Days Per Week | | 5 |

| | Temp. Range | Hours of Occurrence 2-9 | 10-17 | 18-1 | Total Hours | Delta H or T | Const. | CFM | BTU/HR | Total BTU |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 785 | -4 | 1.08 | 1 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 791 | 1 | 1.08 | 1 | 1 | 854 |
| 60 | 64 | 269 | 196 | 236 | 701 | 6 | 1.08 | 1 | 6 | 4,542 |
| 55 | 59 | 249 | 191 | 209 | 649 | 11 | 1.08 | 1 | 12 | 7,710 |
| 50 | 54 | 221 | 193 | 202 | 616 | 16 | 1.08 | 1 | 17 | 10,644 |
| 45 | 49 | 218 | 193 | 206 | 617 | 21 | 1.08 | 1 | 23 | 13,994 |
| 40 | 44 | 237 | 236 | 239 | 712 | 26 | 1.08 | 1 | 28 | 19,993 |
| 35 | 39 | 289 | 246 | 286 | 821 | 31 | 1.08 | 1 | 33 | 27,487 |
| 30 | 34 | 304 | 194 | 258 | 756 | 36 | 1.08 | 1 | 39 | 29,393 |
| 25 | 29 | 184 | 106 | 152 | 442 | 41 | 1.08 | 1 | 44 | 19,572 |
| 20 | 24 | 124 | 65 | 90 | 279 | 46 | 1.08 | 1 | 50 | 13,861 |
| 15 | 19 | 75 | 32 | 57 | 164 | 51 | 1.08 | 1 | 55 | 9,033 |
| 10 | 14 | 54 | 13 | 26 | 93 | 56 | 1.08 | 1 | 60 | 5,625 |
| 5 | 9 | 18 | 3 | 9 | 30 | 61 | 1.08 | 1 | 66 | 1,976 |
| 0 | 4 | 9 | 0 | 2 | 11 | 66 | 1.08 | 1 | 71 | 784 |
| -5 | -1 | 3 | 0 | 1 | 4 | 71 | 1.08 | 1 | 77 | 307 |
| -10 | -6 | 1 | 0 | 0 | 1 | 76 | 1.08 | 1 | 82 | 82 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 1.08 | 1 | 87 | 0 |
| Totals | | 2798 | 2122 | 2552 | 7472 | | | | | 165,858 |

| | | |
|---|---|---|
| Total Operation Hours While Heating (and corrected for working days/week) | 4776 | 118,470 |
| Avg outdoor temp while heating (F) | 45.0 | |

LETTERKENNY ARMY DEPOT ENERGY AUDIT OF INDUSTRIAL FACILITIES

Operation Hrs/Day = 8

Room or Supply Air Conditions - Winter 68
Air Quantity (cfm) 1

Hour Fractions
1 AM - 9 AM 0.25
9 AM - 5 PM 0.75
5 PM - 1 AM 0

Operation Days Per Week 5

| | Temp. Range | Hours of Occurrence 2-9 | 10-17 | 18-1 | Total Hours | Delta H or T | Const. | CFM | BTU/HR | Total BTU |
|---|---|---|---|---|---|---|---|---|---|---|
| 70 | 74 | 247 | 237 | 301 | 240 | -4 | 1.08 | 1 | 0 | 0 |
| 65 | 69 | 296 | 217 | 278 | 237 | 1 | 1.08 | 1 | 1 | 256 |
| 60 | 64 | 269 | 196 | 236 | 214 | 6 | 1.08 | 1 | 6 | 1,388 |
| 55 | 59 | 249 | 191 | 209 | 206 | 11 | 1.08 | 1 | 12 | 2,441 |
| 50 | 54 | 221 | 193 | 202 | 200 | 16 | 1.08 | 1 | 17 | 3,456 |
| 45 | 49 | 218 | 193 | 206 | 199 | 21 | 1.08 | 1 | 23 | 4,519 |
| 40 | 44 | 237 | 236 | 239 | 236 | 26 | 1.08 | 1 | 28 | 6,634 |
| 35 | 39 | 289 | 246 | 286 | 257 | 31 | 1.08 | 1 | 33 | 8,596 |
| 30 | 34 | 304 | 194 | 258 | 222 | 36 | 1.08 | 1 | 39 | 8,612 |
| 25 | 29 | 184 | 106 | 152 | 126 | 41 | 1.08 | 1 | 44 | 5,557 |
| 20 | 24 | 124 | 65 | 90 | 80 | 46 | 1.08 | 1 | 50 | 3,962 |
| 15 | 19 | 75 | 32 | 57 | 43 | 51 | 1.08 | 1 | 55 | 2,355 |
| 10 | 14 | 54 | 13 | 26 | 23 | 56 | 1.08 | 1 | 60 | 1,406 |
| 5 | 9 | 18 | 3 | 9 | 7 | 61 | 1.08 | 1 | 66 | 445 |
| 0 | 4 | 9 | 0 | 2 | 2 | 66 | 1.08 | 1 | 71 | 160 |
| -5 | -1 | 3 | 0 | 1 | 1 | 71 | 1.08 | 1 | 77 | 58 |
| -10 | -6 | 1 | 0 | 0 | 0 | 76 | 1.08 | 1 | 82 | 21 |
| -15 | -11 | 0 | 0 | 0 | 0 | 81 | 1.08 | 1 | 87 | 0 |
| Totals | | 2798 | 2122 | 2552 | 2291 | | | | | 49,865 |

Total Operation Hours While Heating
(and corrected for working days/week) 1465

35,618

Avg outdoor temp while heating (F) 45.0

10/01/91

# ECO Construction Cost Estimate Calculations

ECO Name: Paint Booth Air Flow Control

ECO #: 10

| | |
|---|---|
| 1991 ECO "bare" costs (from cost estimate sheet) | |
| Material | $113,210 |
| Labor | $25,630 |
| Subtotal bare costs | $138,840 |
| FICA Insurance (20% of Labor) | $5,126 |
| Sales Tax (6.5% of Material) | $7,359 |
| Subtotal | $151,325 |
| Overhead (15%) | $22,699 |
| Subtotal | $174,024 |
| Profit (10%) | $17,402 |
| Subtotal | $191,426 |
| Bond (1%) | $1,914 |
| Subtotal | $193,340 |
| Contingency (10%) | $19,334 |
| Subtotal (Construction Cost Input For LCCID *) | $212,674 |
| SIOH (5.5% of Construction Cost) | $11,697 |
| Subtotal | $224,371 |
| Design (6% of Construction Cost) | $12,760 |
| Total Project Cost | $237,131 |

* The SIOH costs (5.5%) and Design costs (6.0%) are automatically added in the Life Cycle Cost In Design (LCCID) analysis program.

| CONSTRUCTION COST ESTIMATE | DATE PREPARED | SHEET OF |
|---|---|---|

PROJECT: ENERGY ENGINEERING ANALYSIS

LOCATION:

ARCHITECT ENGINEER: REYNOLDS, SMITH AND HILLS A.E.P., INC.

BASIS FOR ESTIMATE
- ☐ CODE A (No design completed)
- ☒ CODE B (Preliminary design)
- ☐ CODE C (Final design)
- ☐ OTHER (Specify)

DRAWING NO.: COST FOR ONE BOOTH

ESTIMATOR: G. F

CHECKED BY: P. Hostetler

| SPRAY BOOTH CONTROLS SUMMARY | QUANTITY NO. UNITS | QUANTITY UNIT MEAS. | LABOR PER UNIT | LABOR TOTAL | MATERIAL PER UNIT | MATERIAL TOTAL | TOTAL COST |
|---|---|---|---|---|---|---|---|
| VARI-FREQ DRIVES (1) | 4 | ea | 185 | 740 | 1781 | 7124 | 7864 |
| COPPER TUBING (2) | 300 | ft | 2.42 | 726 | .78 | 234 | 960 |
| FLOW/INDICATING XMTR (2) | 1 | ea | 25 | 25 | 1000 | 1000 | 1025 |
| PRESSURE/INDICATING XMTR (2) | 1 | ea | 25 | 25 | 1000 | 1000 | 1025 |
| PROGRAMABLE LOGIC (2) | 1 | LOT | | 200 | | 800 | 1000 |
| LIMIT SWITCHES (1) | 2 | EA | 3.2 | 164 | 42.00 | 84 | 148 |
| WIRE 2-14 (2) | 2 | CLF | 26.78 | 53.57 | 6.22 | 12.44 | 66 |
| CONDUIT 1/2" ϕ (2) | 200 | LF | 2.97 | 594 | .96 | 192 | 786 |
| CONTROL CABINET (2) | 1 | EA | 135 | 135 | 875 | 875 | 1010 |
| | | | | | | | |
| | | | | 2563 | | 11321 | 13884 |
| | | | | | | | |
| (1) GRAINGER | | | | | | | |
| (2) MEANS | | | | | | | |
| (3) VENDOR QUOTE | | | | | | | |
| | | | | X10 | | X10 | X10 |
| For 10 booths | | | | 25,630 | | 113,210 | 138,840 |

ENG FORM 150
1 AUG 59

(ER 1110-345-730)

PREVIOUS EDITION MAY BE USED

* U.S. GOVERNMENT PRINTING OFFICE : 1958 O—510148

(TRANSLUCENT)

NOTE: VENDOR ADVISES EQUIPMENT BELOW CAN ACCOMODATE 2 BOOTHS. THEREFORE EACH BOOTH COSTS ≈$1000.00

**Cameron & Barkley Company**

Flexible Manufacturing Systems
10200 Alton Box Rd., Box 26879
Jacksonville, FL 32218
(904) 757-0211

**CamBar**

GEORGE FALLON
REYNOLD & SMITH & HILLS
1651 SALISBURY RD.
JACKSONVILLE Fl, 32256

## MODICON COMPACT 984 CONFIGURATION

| | | | | |
|---|---|---|---|---|
| | | **CONTROLLER HARDWARE** | | |
| 1 | 1 | PC-0984-120<br>1.5K Compact-984 CPU | 400.00 | 400.00 |
| | | **MISC ITEMS** | | |
| 2 | 1 | AS-MEEP-000<br>EEPROM Memory Card | ~~200.00~~ | ~~300.00~~ |
| | | **I/O MODULES** | | |
| 3 | 1 | AS-BADU-205<br>+/-10V,+/-20mA analog input module | 375.00 | 375.00 |
| 4 | 1 | AS-BDAP-209<br>115 VAC Output Module | 160.00 | 160.00 |
| 5 | 1 | AS-BDAU-202<br>4-20 mA Analog Input | 435.00 | 435.00 |
| 6 | 1 | AS-BDEP-209<br>115 VAC Input Module | 115.00 | 115.00 |
| 7 | 1 | AS-P120-000<br>120 VAC - 24 VDC Power Converter | 200.00 | 200.00 |
| | | **HOUSINGS** | | |
| 8 | 1 | AS-HDTA-200<br>primary subrack | 165.00 | 165.00 |
| 9 | 1 | AS-HDTA-201<br>secondary subrack - 5 module | 165.00 | 165.00 |
| | | **CABLES** | | |
| 10 | 1 | AS-WBXT-201<br>Bus Extension Cable | 70.00 | 70.00 |
| | | TOTAL AMOUNT: | | ~~2285.00~~ $2085.00 |

NOTE: ALL MODICON EQUIPMENT COMES WITH A THREE YEAR WARRANTY.
PLEASE REFER TO THIS QUOTATION NUMBER. #99-910515-P004

MARK J. WALKER
SYSTEMS SPECIALIST

DEPARTMENT OF THE ARMY
CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS
P.O. BOX 9005
CHAMPAIGN, ILLINOIS 61826-9005

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